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ENGINEERING DESIGN HANDBOOK, EXPERIMENTAL STATISTICS, SECTION 5

December 1969

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ENGINEERING DESIGN HANDBOOK

EXPERIMENTAL STATISTICS

SECTION 5

TABLES

HEADQUARTERS, U.S. ARMY MATERIEL COMMAND DECEMBER 1969

97

HEADQUARTERS
UNITED STATES ARMY MATERIEL COMMAND
WASHINGTON, D.C. 20315

17 December 1969

AMC PAMPHLET
No. 706-114*

ENGINEERING DESIGN HANDBOOK
EXPERIMENTAL STATISTICS (SEC 5)

*This pamphlet supersedes AMCP 706-114, 31 July 1963.

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FOREWORD

INTRODUCTION

This is one of a group of handbooks covering the engineering information and quantitative data needed in the design, development, construction, and test of military equipment which (as a group) constitute the Army Materiel Command Engineering Design Handbook.

PURPOSE OF HANDBOOK

The Handbook on Experimental Statistics has been prepared as an aid to scientists and engineers engaged in Army research and development programs, and especially as a guide and ready reference for military and civilian personnel who have responsibility for the planning and interpretation of experiments and tests relating to the performance of Army equipment in the design and developmental stages of production.

SCOPE AND USE OF HANDBOOK

This Handbook is a collection of statistical procedures and tables. It is presented in five sections, viz:

AMCP 706-110, Section 1, Basic Concepts and Analysis of Measurement Data (Chapters 1-6)

AMCP 706-111, Section 2, Analysis of Enumerative and Classificatory Data (Chapters 7-10)

AMCP 706-112, Section 3, Planning and Analysis of Comparative Experiments (Chapters 11-14)

AMCP 706-113, Section 4, Special Topics (Chapters 15-23)

AMCP 706-114, Section 5, Tables

Section 1 provides an elementary introduction to basic statistical concepts and furnishes full details on standard statistical techniques for the analysis and interpretation of measurement data. Section 2 provides detailed procedures for the analysis and interpretation of enumerative and classificatory data. Section 3 has to do with the planning and analysis of comparative experiments. Section 4 is devoted to consideration and exemplification of a number of important but as yet non-standard statistical techniques, and to discussion of various other special topics. An index for the material in all four sections is placed at the end of Section 4. Section 5 contains all the mathematical tables needed for application of the procedures given in Sections 1 through 4.

An understanding of a few basic statistical concepts, as given in Chapter 1, is necessary; otherwise each of the first four sections is largely independent of the others. Each procedure, test, and technique described is illustrated by means of a worked example. A list of authoritative references is included, where appropriate, at the end of each chapter. Step-by-step instructions are given for attaining a stated goal, and the conditions under which a particular procedure is strictly valid are stated explicitly. An attempt is made to indicate the extent to which results obtained by a given procedure are valid to a good approximation when these conditions are not fully met. Alternative procedures are given for handling cases where the more standard procedures cannot be trusted to yield reliable results.

The Handbook is intended for the user with an engineering background who, although he has an occasional need for statistical techniques, does not have the time or inclination to become an expert on statistical theory and methodology.

The Handbook has been written with three types of users in mind. The first is the person who has had a course or two in statistics, and who may even have had some practical experience in applying statistical methods in the past, but who does not have statistical ideas and techniques at his fingertips. For him, the Handbook will provide a ready reference source of once familiar ideas and techniques. The second is the

person who feels, or has been advised, that some particular problem can be solved by means of fairly simple statistical techniques, and is in need of a book that will enable him to obtain the solution to his problem with a minimum of outside assistance. The Handbook should enable such a person to become familiar with the statistical ideas, and reasonably adept at the techniques, that are most fruitful in his particular line of research and development work. Finally, there is the individual who, as the head of, or as a member of a service group, has responsibility for analyzing and interpreting experimental and test data brought in by scientists and engineers engaged in Army research and development work. This individual needs a ready source of model work sheets and worked examples corresponding to the more common applications of statistics, to free him from the need of translating textbook discussions into step-by-step procedures that can be followed by individuals having little or no previous experience with statistical methods.

It is with this last need in mind that some of the procedures included in the Handbook have been explained and illustrated in detail twice: once for the case where the important question is whether the performance of a new material, product, or process exceeds an established standard; and again for the case where the important question is whether its performance is not up to the specified standards. Small but serious errors are often made in changing "greater than" procedures into "less than" procedures.

AUTHORSHIP AND ACKNOWLEDGMENTS

The Handbook on Experimental Statistics was prepared in the Statistical Engineering Laboratory, National Bureau of Standards, under a contract with the Department of Army. The project was under the general guidance of Churchill Eisenhart, Chief, Statistical Engineering Laboratory.

Most of the present text is by Mary G. Natrella, who had overall responsibility for the completion of the final version of the Handbook. The original plans for coverage, a first draft of the text, and some original tables were prepared by Paul N. Somerville. Chapter 6 is by Joseph M. Cameron; most of Chapter 1 and all of Chapters 20 and 23 are by Churchill Eisenhart; and Chapter 10 is based on a nearly-final draft by Mary L. Epling.

Other members of the staff of the Statistical Engineering Laboratory have aided in various ways through the years, and the assistance of all who helped is gratefully acknowledged. Particular mention should be made of Norman C. Severo, for assistance with Section 2, and of Shirley Young Lehman for help in the collection and computation of examples.

Editorial assistance and art preparation were provided by John I. Thompson & Company, Washington, D. C. Final preparation and arrangement for publication of the Handbook were performed by the Engineering Handbook Office, Duke University.

Appreciation is expressed for the generous cooperation of publishers and authors in granting permission for the use of their source material. References for tables and other material, taken wholly or in part, from published works, are given on the respective first pages.

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Comments and suggestions on this handbook are welcome and should be addressed to Army Research Office-Durham, Box CM, Duke Station, Durham, North Carolina 27706.

PREFACE

This listing is a guide to the Section and Chapter subject coverage in all Sections of the Handbook on Experimental Statistics.

Chapter No. *Title*

SECTION 5

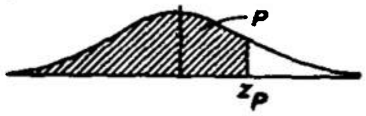
TABLES

This section contains all the mathematical tables referenced throughout Sections 1 through 4 of this handbook, and needed in the application of the given procedures. The tables have been informally arranged in groups as follows: Tables A-1 through A-5 are needed for the "standard" tests of significance; Tables A-6 through A-21 are further tables concerning the analysis of samples from normal distributions; Tables A-22 through A-27 are concerned with analysis of samples from binomial distributions; Tables A-30 through A-35 are for distribution-free techniques; and Tables A-36 and A-37 are sample pages of tables of random numbers and random normal deviates.

THE GREEK ALPHABET

Α	α	alpha	Ν	ν	nu
Β	β	beta	Ξ	ξ	xi
Γ	γ	gamma	Ο	ο	omicron
Δ	δ	delta	Π	π	pi
Ε	ε	epsilon	Ρ	ρ	rho
Ζ	ζ	zeta	Σ	σ	sigma
Η	η	eta	Τ	τ	tau
Θ	θ	theta	Υ	υ	upsilon
Ι	ι	iota	Φ	φ	phi
Κ	κ	kappa	Χ	χ	chi
Λ	λ	lambda	Ψ	ψ	psi
Μ	μ	mu	Ω	ω	omega

TABLE A-1. CUMULATIVE NORMAL DISTRIBUTION — VALUES OF P



Values of P corresponding to z_p for the normal curve.

z is the standard normal variable. The value of P for $-z_p$ equals one minus the value of P for $+z_p$, e.g., the P for -1.62 equals $1 - .9474 = .0526$.

z_p	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

TABLE A-2. CUMULATIVE NORMAL DISTRIBUTION — VALUES OF z_P

Values of z_P corresponding to P for the normal curve.

z is the standard normal variable

P	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.00	—	−2.33	−2.05	−1.88	−1.75	−1.64	−1.55	−1.48	−1.41	−1.34
.10	−1.28	−1.23	−1.18	−1.13	−1.08	−1.04	−0.99	−0.95	−0.92	−0.88
.20	−0.84	−0.81	−0.77	−0.74	−0.71	−0.67	−0.64	−0.61	−0.58	−0.55
.30	−0.52	−0.50	−0.47	−0.44	−0.41	−0.39	−0.36	−0.33	−0.31	−0.28
.40	−0.25	−0.23	−0.20	−0.18	−0.15	−0.13	−0.10	−0.08	−0.05	−0.03
.50	0.00	0.03	0.05	0.08	0.10	0.13	0.15	0.18	0.20	0.23
.60	0.25	0.28	0.31	0.33	0.36	0.39	0.41	0.44	0.47	0.50
.70	0.52	0.55	0.58	0.61	0.64	0.67	0.71	0.74	0.77	0.81
.80	0.84	0.88	0.92	0.95	0.99	1.04	1.08	1.13	1.18	1.23
.90	1.28	1.34	1.41	1.48	1.55	1.64	1.75	1.88	2.05	2.33

Special Values

P	.001	.005	.010	.025	.050	.100
z_P	−3.090	−2.576	−2.326	−1.960	−1.645	−1.282

P	.999	.995	.990	.975	.950	.900
z_P	3.090	2.576	2.326	1.960	1.645	1.282

TABLE A-3. PERCENTILES OF THE χ^2 DISTRIBUTION

Values of χ^2_P corresponding to P

df	$\chi^2_{.005}$	$\chi^2_{.01}$	$\chi^2_{.025}$	$\chi^2_{.05}$	$\chi^2_{.10}$	$\chi^2_{.90}$	$\chi^2_{.95}$	$\chi^2_{.975}$	$\chi^2_{.99}$	$\chi^2_{.995}$
1	.000039	.00016	.00098	.0039	.0158	2.71	3.84	5.02	6.63	7.88
2	.0100	.0201	.0506	.1026	.2107	4.61	5.99	7.38	9.21	10.60
3	.0717	.115	.216	.352	.584	6.25	7.81	9.35	11.34	12.84
4	.207	.297	.484	.711	1.064	7.78	9.49	11.14	13.28	14.86
5	.412	.554	.831	1.15	1.61	9.24	11.07	12.83	15.09	16.75
6	.676	.872	1.24	1.64	2.20	10.64	12.59	14.45	16.81	18.55
7	.989	1.24	1.69	2.17	2.83	12.02	14.07	16.01	18.48	20.28
8	1.34	1.65	2.18	2.73	3.49	13.36	15.51	17.53	20.09	21.96
9	1.73	2.09	2.70	3.33	4.17	14.68	16.92	19.02	21.67	23.59
10	2.16	2.56	3.25	3.94	4.87	15.99	18.31	20.48	23.21	25.19
11	2.60	3.05	3.82	4.57	5.58	17.28	19.68	21.92	24.73	26.76
12	3.07	3.57	4.40	5.23	6.30	18.55	21.03	23.34	26.22	28.30
13	3.57	4.11	5.01	5.89	7.04	19.81	22.36	24.74	27.69	29.82
14	4.07	4.66	5.63	6.57	7.79	21.06	23.68	26.12	29.14	31.32
15	4.60	5.23	6.26	7.26	8.55	22.31	25.00	27.49	30.58	32.80
16	5.14	5.81	6.91	7.96	9.31	23.54	26.30	28.85	32.00	34.27
18	6.26	7.01	8.23	9.39	10.86	25.99	28.87	31.53	34.81	37.16
20	7.43	8.26	9.59	10.85	12.44	28.41	31.41	34.17	37.57	40.00
24	9.89	10.86	12.40	13.85	15.66	33.20	36.42	39.36	42.98	45.56
30	13.79	14.95	16.79	18.49	20.60	40.26	43.77	46.98	50.89	53.67
40	20.71	22.16	24.43	26.51	29.05	51.81	55.76	59.34	63.69	66.77
60	35.53	37.48	40.48	43.19	46.46	74.40	79.08	83.30	88.38	91.95
120	83.85	86.92	91.58	95.70	100.62	140.23	146.57	152.21	158.95	163.64

For large degrees of freedom,

$$\chi^2_P = \tfrac{1}{2}(z_P + \sqrt{2\nu - 1})^2 \text{ approximately,}$$

where ν = degrees of freedom and z_P is given in Table A-2.

TABLE A-4. PERCENTILES OF THE t DISTRIBUTION

df	$t_{.60}$	$t_{.70}$	$t_{.80}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$
1	.325	.727	1.376	3.078	6.314	12.706	31.821	63.657
2	.289	.617	1.061	1.886	2.920	4.303	6.965	9.925
3	.277	.584	.978	1.638	2.353	3.182	4.541	5.841
4	.271	.569	.941	1.533	2.132	2.776	3.747	4.604
5	.267	.559	.920	1.476	2.015	2.571	3.365	4.032
6	.265	.553	.906	1.440	1.943	2.447	3.143	3.707
7	.263	.549	.896	1.415	1.895	2.365	2.998	3.499
8	.262	.546	.889	1.397	1.860	2.306	2.896	3.355
9	.261	.543	.883	1.383	1.833	2.262	2.821	3.250
10	.260	.542	.879	1.372	1.812	2.228	2.764	3.169
11	.260	.540	.876	1.363	1.796	2.201	2.718	3.106
12	.259	.539	.873	1.356	1.782	2.179	2.681	3.055
13	.259	.538	.870	1.350	1.771	2.160	2.650	3.012
14	.258	.537	.868	1.345	1.761	2.145	2.624	2.977
15	.258	.536	.866	1.341	1.753	2.131	2.602	2.947
16	.258	.535	.865	1.337	1.746	2.120	2.583	2.921
17	.257	.534	.863	1.333	1.740	2.110	2.567	2.898
18	.257	.534	.862	1.330	1.734	2.101	2.552	2.878
19	.257	.533	.861	1.328	1.729	2.093	2.539	2.861
20	.257	.533	.860	1.325	1.725	2.086	2.528	2.845
21	.257	.532	.859	1.323	1.721	2.080	2.518	2.831
22	.256	.532	.858	1.321	1.717	2.074	2.508	2.819
23	.256	.532	.858	1.319	1.714	2.069	2.500	2.807
24	.256	.531	.857	1.318	1.711	2.064	2.492	2.797
25	.256	.531	.856	1.316	1.708	2.060	2.485	2.787
26	.256	.531	.856	1.315	1.706	2.056	2.479	2.779
27	.256	.531	.855	1.314	1.703	2.052	2.473	2.771
28	.256	.530	.855	1.313	1.701	2.048	2.467	2.763
29	.256	.530	.854	1.311	1.699	2.045	2.462	2.756
30	.256	.530	.854	1.310	1.697	2.042	2.457	2.750
40	.255	.529	.851	1.303	1.684	2.021	2.423	2.704
60	.254	.527	.848	1.296	1.671	2.000	2.390	2.660
120	.254	.526	.845	1.289	1.658	1.980	2.358	2.617
∞	.253	.524	.842	1.282	1.645	1.960	2.326	2.576

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TABLE A-5. PERCENTILES OF THE F DISTRIBUTION

$F_{.90}(n_1, n_2)$

n_1 = degrees of freedom for numerator

n_2 = degrees of freedom for denominator

n_2 \ n_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	59.86	60.19	60.71	61.22	61.74	62.00	62.26	62.53	62.79	63.06	63.33
2	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.38	9.39	9.41	9.42	9.44	9.45	9.46	9.47	9.47	9.48	9.49
3	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.24	5.23	5.22	5.20	5.18	5.18	5.17	5.16	5.15	5.14	5.13
4	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.94	3.92	3.90	3.87	3.84	3.83	3.82	3.80	3.79	3.78	3.76
5	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.32	3.30	3.27	3.24	3.21	3.19	3.17	3.16	3.14	3.12	3.10
6	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.96	2.94	2.90	2.87	2.84	2.82	2.80	2.78	2.76	2.74	2.72
7	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.72	2.70	2.67	2.63	2.59	2.58	2.56	2.54	2.51	2.49	2.47
8	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.56	2.50	2.50	2.46	2.42	2.40	2.38	2.36	2.34	2.32	2.29
9	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.44	2.42	2.38	2.34	2.30	2.28	2.25	2.23	2.21	2.18	2.16
10	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.35	2.32	2.28	2.24	2.20	2.18	2.16	2.13	2.11	2.08	2.06
11	3.23	2.86	2.66	2.54	2.45	2.39	2.34	2.30	2.27	2.25	2.21	2.17	2.12	2.10	2.08	2.05	2.03	2.00	1.97
12	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.21	2.19	2.15	2.10	2.06	2.04	2.01	1.99	1.96	1.93	1.90
13	3.14	2.76	2.56	2.43	2.35	2.28	2.23	2.20	2.16	2.14	2.10	2.05	2.01	1.98	1.96	1.93	1.90	1.88	1.85
14	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.12	2.10	2.05	2.01	1.96	1.94	1.91	1.89	1.86	1.83	1.80
15	3.07	2.70	2.49	2.36	2.27	2.21	2.16	2.12	2.09	2.06	2.02	1.97	1.92	1.90	1.87	1.85	1.82	1.79	1.76
16	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	2.06	2.03	1.99	1.94	1.89	1.87	1.84	1.81	1.78	1.75	1.72
17	3.03	2.64	2.44	2.31	2.22	2.15	2.10	2.06	2.03	2.00	1.96	1.91	1.86	1.84	1.81	1.78	1.75	1.72	1.69
18	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	2.00	1.98	1.93	1.89	1.84	1.81	1.78	1.75	1.72	1.69	1.66
19	2.99	2.61	2.40	2.27	2.18	2.11	2.06	2.02	1.98	1.96	1.91	1.86	1.81	1.79	1.76	1.73	1.70	1.67	1.63
20	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.96	1.94	1.89	1.84	1.79	1.77	1.74	1.71	1.68	1.64	1.61
21	2.96	2.57	2.36	2.23	2.14	2.08	2.02	1.98	1.96	1.92	1.87	1.83	1.78	1.75	1.72	1.69	1.66	1.62	1.59
22	2.95	2.56	2.35	2.22	2.13	2.06	2.01	1.97	1.93	1.90	1.86	1.81	1.76	1.73	1.70	1.67	1.64	1.60	1.57
23	2.94	2.55	2.34	2.21	2.11	2.05	1.99	1.95	1.92	1.89	1.84	1.80	1.74	1.72	1.69	1.66	1.62	1.59	1.55
24	2.93	2.54	2.33	2.19	2.10	2.04	1.98	1.94	1.91	1.88	1.83	1.78	1.73	1.70	1.67	1.64	1.61	1.57	1.53
25	2.92	2.53	2.32	2.18	2.09	2.02	1.97	1.93	1.89	1.87	1.82	1.77	1.72	1.69	1.66	1.63	1.59	1.56	1.52
26	2.91	2.52	2.31	2.17	2.08	2.01	1.96	1.92	1.88	1.86	1.81	1.76	1.71	1.68	1.65	1.61	1.58	1.54	1.50
27	2.90	2.51	2.30	2.17	2.07	2.00	1.95	1.91	1.87	1.85	1.80	1.75	1.70	1.67	1.64	1.60	1.57	1.53	1.49
28	2.89	2.50	2.29	2.16	2.06	2.00	1.94	1.90	1.87	1.84	1.79	1.74	1.69	1.66	1.63	1.59	1.56	1.52	1.48
29	2.89	2.50	2.28	2.15	2.06	1.99	1.93	1.89	1.86	1.83	1.78	1.73	1.68	1.65	1.62	1.58	1.55	1.51	1.47
30	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.85	1.82	1.77	1.72	1.67	1.64	1.61	1.57	1.54	1.50	1.46
40	2.84	2.44	2.23	2.09	2.00	1.93	1.87	1.83	1.79	1.76	1.71	1.66	1.61	1.57	1.54	1.51	1.47	1.42	1.38
60	2.79	2.39	2.18	2.04	1.95	1.87	1.82	1.77	1.74	1.71	1.66	1.60	1.54	1.51	1.48	1.44	1.40	1.35	1.29
120	2.75	2.35	2.13	1.99	1.90	1.82	1.77	1.72	1.68	1.65	1.60	1.55	1.48	1.45	1.41	1.37	1.32	1.26	1.19
∞	2.71	2.30	2.08	1.94	1.85	1.77	1.72	1.67	1.63	1.60	1.55	1.49	1.42	1.38	1.34	1.30	1.24	1.17	1.00

TABLE A-5 (Continued). PERCENTILES OF THE F DISTRIBUTION

$F_{.95}(n_1, n_2)$

n_1 = degrees of freedom for numerator

n_2 = degrees of freedom for denominator

n_2 \ n_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

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TABLE A-5 (Continued). PERCENTILES OF THE F DISTRIBUTION

$F_{.975}(n_1, n_2)$

n_1 = degrees of freedom for numerator

n_2 = degrees of freedom for denominator

n_2 \ n_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	647.8	799.5	864.2	899.6	921.8	937.1	948.2	956.7	963.3	968.6	976.7	984.9	993.1	997.2	1001	1006	1010	1014	1018
2	38.51	39.00	39.17	39.25	39.30	39.33	39.36	39.37	39.39	39.40	39.41	39.43	39.45	39.46	39.46	39.47	39.48	39.49	39.50
3	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47	14.42	14.34	14.25	14.17	14.12	14.08	14.04	13.99	13.95	13.90
4	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.75	8.66	8.56	8.51	8.46	8.41	8.36	8.31	8.26
5	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.52	6.43	6.33	6.28	6.23	6.18	6.12	6.07	6.02
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.37	5.27	5.17	5.12	5.07	5.01	4.96	4.90	4.85
7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.67	4.57	4.47	4.42	4.36	4.31	4.25	4.20	4.14
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.20	4.10	4.00	3.95	3.89	3.84	3.78	3.73	3.67
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.87	3.77	3.67	3.61	3.56	3.51	3.45	3.39	3.33
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.62	3.52	3.42	3.37	3.31	3.26	3.20	3.14	3.08
11	6.72	5.26	4.63	4.28	4.04	3.88	3.76	3.66	3.59	3.53	3.43	3.33	3.23	3.17	3.12	3.06	3.00	2.94	2.88
12	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.44	3.37	3.28	3.18	3.07	3.02	2.96	2.91	2.85	2.79	2.72
13	6.41	4.97	4.35	4.00	3.77	3.60	3.48	3.39	3.31	3.25	3.15	3.05	2.95	2.89	2.84	2.78	2.72	2.66	2.60
14	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.21	3.15	3.05	2.95	2.84	2.79	2.73	2.67	2.61	2.55	2.49
15	6.20	4.77	4.15	3.80	3.58	3.41	3.29	3.20	3.12	3.06	2.96	2.86	2.76	2.70	2.64	2.59	2.52	2.46	2.40
16	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	3.05	2.99	2.89	2.79	2.68	2.63	2.57	2.51	2.45	2.38	2.32
17	6.04	4.62	4.01	3.66	3.44	3.28	3.16	3.06	2.98	2.92	2.82	2.72	2.62	2.56	2.50	2.44	2.38	2.32	2.25
18	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.93	2.87	2.77	2.67	2.56	2.50	2.44	2.38	2.32	2.26	2.19
19	5.92	4.51	3.90	3.56	3.33	3.17	3.05	2.96	2.88	2.82	2.72	2.62	2.51	2.45	2.39	2.33	2.27	2.20	2.13
20	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.84	2.77	2.68	2.57	2.46	2.41	2.35	2.29	2.22	2.16	2.09
21	5.83	4.42	3.82	3.48	3.25	3.09	2.97	2.87	2.80	2.73	2.64	2.53	2.42	2.37	2.31	2.25	2.18	2.11	2.04
22	5.79	4.38	3.78	3.44	3.22	3.05	2.93	2.84	2.76	2.70	2.60	2.50	2.39	2.33	2.27	2.21	2.14	2.08	2.00
23	5.75	4.35	3.75	3.41	3.18	3.02	2.90	2.81	2.73	2.67	2.57	2.47	2.36	2.30	2.24	2.18	2.11	2.04	1.97
24	5.72	4.32	3.72	3.38	3.15	2.99	2.87	2.78	2.70	2.64	2.54	2.44	2.33	2.27	2.21	2.15	2.08	2.01	1.94
25	5.69	4.29	3.69	3.35	3.13	2.97	2.85	2.75	2.68	2.61	2.51	2.41	2.30	2.24	2.18	2.12	2.05	1.98	1.91
26	5.66	4.27	3.67	3.33	3.10	2.94	2.82	2.73	2.65	2.59	2.49	2.39	2.28	2.22	2.16	2.09	2.03	1.95	1.88
27	5.63	4.24	3.65	3.31	3.08	2.92	2.80	2.71	2.63	2.57	2.47	2.36	2.25	2.19	2.13	2.07	2.00	1.93	1.85
28	5.61	4.22	3.63	3.29	3.06	2.90	2.78	2.69	2.61	2.55	2.45	2.34	2.23	2.17	2.11	2.05	1.98	1.91	1.83
29	5.59	4.20	3.61	3.27	3.04	2.88	2.76	2.67	2.59	2.53	2.43	2.32	2.21	2.15	2.09	2.03	1.96	1.89	1.81
30	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.57	2.51	2.41	2.31	2.20	2.14	2.07	2.01	1.94	1.87	1.79
40	5.42	4.05	3.46	3.13	2.90	2.74	2.62	2.53	2.45	2.39	2.29	2.18	2.07	2.01	1.94	1.88	1.80	1.72	1.64
60	5.29	3.93	3.34	3.01	2.79	2.63	2.51	2.41	2.33	2.27	2.17	2.06	1.94	1.88	1.82	1.74	1.67	1.58	1.48
120	5.15	3.80	3.23	2.89	2.67	2.52	2.39	2.30	2.22	2.16	2.05	1.94	1.82	1.76	1.69	1.61	1.53	1.43	1.31
∞	5.02	3.69	3.12	2.79	2.57	2.41	2.29	2.19	2.11	2.05	1.94	1.83	1.71	1.64	1.57	1.48	1.39	1.27	1.00

TABLE A-5 (Continued). PERCENTILES OF THE F DISTRIBUTION

$F_{.99}(n_1, n_2)$

n_1 = degrees of freedom for numerator

n_2 = degrees of freedom for denominator

n_2 \ n_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	4052	4999.5	5403	5625	5764	5859	5928	5982	6022	6056	6106	6157	6209	6235	6261	6287	6313	6339	6366
2	98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39	99.40	99.42	99.43	99.45	99.46	99.47	99.47	99.48	99.49	99.50
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23	27.05	26.87	26.69	26.60	26.50	26.41	26.32	26.22	26.13
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.37	14.20	14.02	13.93	13.84	13.75	13.65	13.56	13.46
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05	9.89	9.72	9.55	9.47	9.38	9.29	9.20	9.11	9.02
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.72	7.56	7.40	7.31	7.23	7.14	7.06	6.97	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.47	6.31	6.16	6.07	5.99	5.91	5.82	5.74	5.65
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.67	5.52	5.36	5.28	5.20	5.12	5.03	4.95	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.11	4.96	4.81	4.73	4.65	4.57	4.48	4.40	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.71	4.56	4.41	4.33	4.25	4.17	4.08	4.00	3.91
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54	4.40	4.25	4.10	4.02	3.94	3.86	3.78	3.69	3.60
12	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.39	4.30	4.16	4.01	3.86	3.78	3.70	3.62	3.54	3.45	3.36
13	9.07	6.70	5.74	5.21	4.86	4.62	4.44	4.30	4.19	4.10	3.96	3.82	3.66	3.59	3.51	3.43	3.34	3.25	3.17
14	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94	3.80	3.66	3.51	3.43	3.35	3.27	3.18	3.09	3.00
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.67	3.52	3.37	3.29	3.21	3.13	3.05	2.96	2.87
16	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.78	3.69	3.55	3.41	3.26	3.18	3.10	3.02	2.93	2.84	2.75
17	8.40	6.11	5.18	4.67	4.34	4.10	3.93	3.79	3.68	3.59	3.46	3.31	3.16	3.08	3.00	2.92	2.83	2.75	2.65
18	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.60	3.51	3.37	3.23	3.08	3.00	2.92	2.84	2.75	2.66	2.57
19	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.30	3.15	3.00	2.92	2.84	2.76	2.67	2.58	2.49
20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	3.23	3.09	2.94	2.86	2.78	2.69	2.61	2.52	2.42
21	8.02	5.78	4.87	4.37	4.04	3.81	3.64	3.51	3.40	3.31	3.17	3.03	2.88	2.80	2.72	2.64	2.55	2.46	2.36
22	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.12	2.98	2.83	2.75	2.67	2.58	2.50	2.40	2.31
23	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.07	2.93	2.78	2.70	2.62	2.54	2.45	2.35	2.26
24	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.26	3.17	3.03	2.89	2.74	2.66	2.58	2.49	2.40	2.31	2.21
25	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22	3.13	2.99	2.85	2.70	2.62	2.54	2.45	2.36	2.27	2.17
26	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09	2.96	2.81	2.66	2.58	2.50	2.42	2.33	2.23	2.13
27	7.68	5.49	4.60	4.11	3.78	3.56	3.39	3.26	3.15	3.06	2.93	2.78	2.63	2.55	2.47	2.38	2.29	2.20	2.10
28	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03	2.90	2.75	2.60	2.52	2.44	2.35	2.26	2.17	2.06
29	7.60	5.42	4.54	4.04	3.73	3.50	3.33	3.20	3.09	3.00	2.87	2.73	2.57	2.49	2.41	2.33	2.23	2.14	2.03
30	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07	2.98	2.84	2.70	2.55	2.47	2.39	2.30	2.21	2.11	2.01
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.66	2.52	2.37	2.29	2.20	2.11	2.02	1.92	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.50	2.35	2.20	2.12	2.03	1.94	1.84	1.73	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.34	2.19	2.03	1.95	1.86	1.76	1.66	1.53	1.38
∞	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	2.18	2.04	1.88	1.79	1.70	1.59	1.47	1.32	1.00

TABLE A-6. FACTORS FOR TWO-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS

Factors K such that the probability is γ that at least a proportion P of the distribution will be included between $\bar{X} \pm Ks$, where $\bar{X}$ and s are estimates of the mean and the standard deviation computed from a sample size of n.

	$\gamma = 0.75$					$\gamma = 0.90$				
n \ P	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
2	4.498	6.301	7.414	9.531	11.920	11.407	15.978	18.800	24.167	30.227
3	2.501	3.538	4.187	5.431	6.844	4.132	5.847	6.919	8.974	11.309
4	2.035	2.892	3.431	4.471	5.657	2.932	4.166	4.943	6.440	8.149
5	1.825	2.599	3.088	4.033	5.117	2.454	3.494	4.152	5.423	6.879
6	1.704	2.429	2.889	3.779	4.802	2.196	3.131	3.723	4.870	6.188
7	1.624	2.318	2.757	3.611	4.593	2.034	2.902	3.452	4.521	5.750
8	1.568	2.238	2.663	3.491	4.444	1.921	2.743	3.264	4.278	5.446
9	1.525	2.178	2.593	3.400	4.330	1.839	2.626	3.125	4.098	5.220
10	1.492	2.131	2.537	3.328	4.241	1.775	2.535	3.018	3.959	5.046
11	1.465	2.093	2.493	3.271	4.169	1.724	2.463	2.933	3.849	4.906
12	1.443	2.062	2.456	3.223	4.110	1.683	2.404	2.863	3.758	4.792
13	1.425	2.036	2.424	3.183	4.059	1.648	2.355	2.805	3.682	4.697
14	1.409	2.013	2.398	3.148	4.016	1.619	2.314	2.756	3.618	4.615
15	1.395	1.994	2.575	3.118	3.979	1.594	2.278	2.713	3.562	4.545
16	1.383	1.977	2.355	3.092	3.946	1.572	2.246	2.676	3.514	4.484
17	1.372	1.962	2.337	3.069	3.917	1.552	2.219	2.643	3.471	4.430
18	1.363	1.948	2.321	3.048	3.891	1.535	2.194	2.614	3.433	4.382
19	1.355	1.936	2.307	3.030	3.867	1.520	2.172	2.588	3.399	4.339
20	1.347	1.925	2.294	3.013	3.846	1.506	2.152	2.564	3.368	4.300
21	1.340	1.915	2.282	2.998	3.827	1.493	2.135	2.543	3.340	4.264
22	1.334	1.906	2.271	2.984	3.809	1.482	2.118	2.524	3.315	4.232
23	1.328	1.898	2.261	2.971	3.793	1.471	2.103	2.506	3.292	4.203
24	1.322	1.891	2.252	2.959	3.778	1.462	2.089	2.489	3.270	4.176
25	1.317	1.883	2.244	2.948	3.764	1.453	2.077	2.474	3.251	4.151
26	1.313	1.877	2.236	2.938	3.751	1.444	2.065	2.460	3.232	4.127
27	1.309	1.871	2.229	2.929	3.740	1.437	2.054	2.447	3.215	4.106

TABLE A-6 (Continued). FACTORS FOR TWO-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS

	γ = 0.95					γ = 0.99				
n \ P	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
2	22.858	32.019	37.674	48.430	60.573	114.363	160.193	188.491	242.300	303.054
3	5.922	8.380	9.916	12.861	16.208	13.378	18.930	22.401	29.055	36.616
4	3.779	5.369	6.370	8.299	10.502	6.614	9.398	11.150	14.527	18.383
5	3.002	4.275	5.079	6.634	8.415	4.643	6.612	7.855	10.260	13.015
6	2.604	3.712	4.414	5.775	7.337	3.743	5.337	6.345	8.301	10.548
7	2.361	3.369	4.007	5.248	6.676	3.233	4.613	5.488	7.187	9.142
8	2.197	3.136	3.732	4.891	6.226	2.905	4.147	4.936	6.468	8.234
9	2.078	2.967	3.532	4.631	5.899	2.677	3.822	4.550	5.966	7.600
10	1.987	2.839	3.379	4.433	5.649	2.508	3.582	4.265	5.594	7.129
11	1.916	2.737	3.259	4.277	5.452	2.378	3.397	4.045	5.308	6.766
12	1.858	2.655	3.162	4.150	5.291	2.274	3.250	3.870	5.079	6.477
13	1.810	2.587	3.081	4.044	5.158	2.190	3.130	3.727	4.893	6.240
14	1.770	2.529	3.012	3.955	5.045	2.120	3.029	3.608	4.737	6.043
15	1.735	2.480	2.954	3.878	4.949	2.060	2.945	3.507	4.605	5.876
16	1.705	2.437	2.903	3.812	4.865	2.009	2.872	3.421	4.492	5.732
17	1.679	2.400	2.858	3.754	4.791	1.965	2.808	3.345	4.393	5.607
18	1.655	2.366	2.819	3.702	4.725	1.926	2.753	3.279	4.307	5.497
19	1.635	2.337	2.784	3.656	4.667	1.891	2.703	3.221	4.230	5.399
20	1.616	2.310	2.752	3.615	4.614	1.860	2.659	3.168	4.161	5.312
21	1.599	2.286	2.723	3.577	4.567	1.833	2.620	3.121	4.100	5.234
22	1.584	2.264	2.697	3.543	4.523	1.808	2.584	3.078	4.044	5.163
23	1.570	2.244	2.673	3.512	4.484	1.785	2.551	3.040	3.993	5.098
24	1.557	2.225	2.651	3.483	4.447	1.764	2.522	3.004	3.947	5.039
25	1.545	2.208	2.631	3.457	4.413	1.745	2.494	2.972	3.904	4.985
26	1.534	2.193	2.612	3.432	4.382	1.727	2.469	2.941	3.865	4.935
27	1.523	2.178	2.595	3.409	4.353	1.711	2.446	2.914	3.828	4.888

TABLE A-6 (Continued). FACTORS FOR TWO-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS

	γ = 0.75					γ = 0.90				
n \ P	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
30	1.297	1.855	2.210	2.904	3.708	1.417	2.025	2.413	3.170	4.049
35	1.283	1.834	2.185	2.871	3.667	1.390	1.988	2.368	3.112	3.974
40	1.271	1.818	2.166	2.846	3.635	1.370	1.959	2.334	3.066	3.917
45	1.262	1.805	2.150	2.826	3.609	1.354	1.935	2.306	3.030	3.871
50	1.255	1.794	2.138	2.809	3.588	1.340	1.916	2.284	3.001	3.833
55	1.249	1.785	2.127	2.795	3.571	1.329	1.901	2.265	2.976	3.801
60	1.243	1.778	2.118	2.784	3.556	1.320	1.887	2.248	2.955	3.774
65	1.239	1.771	2.110	2.773	3.543	1.312	1.875	2.235	2.937	3.751
70	1.235	1.765	2.104	2.764	3.531	1.304	1.865	2.222	2.920	3.730
75	1.231	1.760	2.098	2.757	3.521	1.298	1.856	2.211	2.906	3.712
80	1.228	1.756	2.092	2.749	3.512	1.292	1.848	2.202	2.894	3.696
85	1.225	1.752	2.087	2.743	3.504	1.287	1.841	2.193	2.882	3.682
90	1.223	1.748	2.083	2.737	3.497	1.283	1.834	2.185	2.872	3.669
95	1.220	1.745	2.079	2.732	3.490	1.278	1.828	2.178	2.863	3.657
100	1.218	1.742	2.075	2.727	3.484	1.275	1.822	2.172	2.854	3.646
110	1.214	1.736	2.069	2.719	3.473	1.268	1.813	2.160	2.839	3.626
120	1.211	1.732	2.063	2.712	3.464	1.262	1.804	2.150	2.826	3.610
130	1.208	1.728	2.059	2.705	3.456	1.257	1.797	2.141	2.814	3.595
140	1.206	1.724	2.054	2.700	3.449	1.252	1.791	2.134	2.804	3.582
150	1.204	1.721	2.051	2.695	3.443	1.248	1.785	2.127	2.795	3.571
160	1.202	1.718	2.047	2.691	3.437	1.245	1.780	2.121	2.787	3.561
170	1.200	1.716	2.044	2.687	3.432	1.242	1.775	2.116	2.780	3.552
180	1.198	1.713	2.042	2.683	3.427	1.239	1.771	2.111	2.774	3.543
190	1.197	1.711	2.039	2.680	3.423	1.236	1.767	2.106	2.768	3.536
200	1.195	1.709	2.037	2.677	3.419	1.234	1.764	2.102	2.762	3.529
250	1.190	1.702	2.028	2.665	3.404	1.224	1.750	2.085	2.740	3.501
300	1.186	1.696	2.021	2.656	3.393	1.217	1.740	2.073	2.725	3.481
400	1.181	1.688	2.012	2.644	3.378	1.207	1.726	2.057	2.703	3.453
500	1.177	1.683	2.006	2.636	3.368	1.201	1.717	2.046	2.689	3.434
600	1.175	1.680	2.002	2.631	3.360	1.196	1.710	2.038	2.678	3.421
700	1.173	1.677	1.998	2.626	3.355	1.192	1.705	2.032	2.670	3.411
800	1.171	1.675	1.996	2.623	3.350	1.189	1.701	2.027	2.663	3.402
900	1.170	1.673	1.993	2.620	3.347	1.187	1.697	2.023	2.658	3.396
1000	1.169	1.671	1.992	2.617	3.344	1.185	1.695	2.019	2.654	3.390
∞	1.150	1.645	1.960	2.576	3.291	1.150	1.645	1.960	2.576	3.291

TABLE A-6 (Continued). FACTORS FOR TWO-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS

	$\gamma = 0.95$					$\gamma = 0.99$				
n \ P	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
30	1.497	2.140	2.549	3.350	4.278	1.668	2.385	2.841	3.733	4.768
35	1.462	2.090	2.490	3.272	4.179	1.613	2.306	2.748	3.611	4.611
40	1.435	2.052	2.445	3.213	4.104	1.571	2.247	2.677	3.518	4.493
45	1.414	2.021	2.408	3.165	4.042	1.539	2.200	2.621	3.444	4.399
50	1.396	1.996	2.379	3.126	3.993	1.512	2.162	2.576	3.385	4.323
55	1.382	1.976	2.354	3.094	3.951	1.490	2.130	2.538	3.335	4.260
60	1.369	1.958	2.333	3.066	3.916	1.471	2.103	2.506	3.293	4.206
65	1.359	1.943	2.315	3.042	3.886	1.455	2.080	2.478	3.257	4.160
70	1.349	1.929	2.299	3.021	3.859	1.440	2.060	2.454	3.225	4.120
75	1.341	1.917	2.285	3.002	3.835	1.428	2.042	2.433	3.197	4.084
80	1.334	1.907	2.272	2.986	3.814	1.417	2.026	2.414	3.173	4.053
85	1.327	1.897	2.261	2.971	3.795	1.407	2.012	2.397	3.150	4.024
90	1.321	1.889	2.251	2.958	3.778	1.398	1.999	2.382	3.130	3.999
95	1.315	1.881	2.241	2.945	3.763	1.390	1.987	2.368	3.112	3.976
100	1.311	1.874	2.233	2.934	3.748	1.383	1.977	2.355	3.096	3.954
110	1.302	1.861	2.218	2.915	3.723	1.369	1.958	2.333	3.066	3.917
120	1.294	1.850	2.205	2.898	3.702	1.358	1.942	2.314	3.041	3.885
130	1.288	1.841	2.194	2.883	3.683	1.349	1.928	2.298	3.019	3.857
140	1.282	1.833	2.184	2.870	3.666	1.340	1.916	2.283	3.000	3.833
150	1.277	1.825	2.175	2.859	3.652	1.332	1.905	2.270	2.983	3.811
160	1.272	1.819	2.167	2.848	3.638	1.326	1.896	2.259	2.968	3.792
170	1.268	1.813	2.160	2.839	3.527	1.320	1.887	2.248	2.955	3.774
180	1.264	1.808	2.154	2.831	3.616	1.314	1.879	2.239	2.942	3.759
190	1.261	1.803	2.148	2.823	3.606	1.309	1.872	2.230	2.931	3.744
200	1.258	1.798	2.143	2.816	3.597	1.304	1.865	2.222	2.921	3.731
250	1.245	1.780	2.121	2.788	3.561	1.286	1.839	2.191	2.880	3.678
300	1.236	1.767	2.106	2.767	3.535	1.273	1.820	2.169	2.850	3.641
400	1.223	1.749	2.084	2.739	3.499	1.255	1.794	2.138	2.809	3.589
500	1.215	1.737	2.070	2.721	3.475	1.243	1.777	2.117	2.783	3.555
600	1.209	1.729	2.060	2.707	3.458	1.234	1.764	2.102	2.763	3.530
700	1.204	1.722	2.052	2.697	3.445	1.227	1.755	2.091	2.748	3.511
800	1.201	1.717	2.046	2.688	3.434	1.222	1.747	2.082	2.736	3.495
900	1.198	1.712	2.040	2.682	3.426	1.218	1.741	2.075	2.726	3.483
1000	1.195	1.709	2.036	2.676	3.418	1.214	1.736	2.068	2.718	3.472
∞	1.150	1.645	1.960	2.576	3.291	1.150	1.645	1.960	2.576	3.291

TABLE A-7. FACTORS FOR ONE-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS

Factors K such that the probability is γ that at least a proportion P of the distribution will be less than $\bar{X} + Ks$ (or greater than $\bar{X} - Ks$), where $\bar{X}$ and s are estimates of the mean and the standard deviation computed from a sample size of n.

	$\gamma = 0.75$					$\gamma = 0.90$				
n \ P	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
3	1.464	2.501	3.152	4.396	5.805	2.602	4.258	5.310	7.340	9.651
4	1.256	2.134	2.680	3.726	4.910	1.972	3.187	3.957	5.437	7.128
5	1.152	1.961	2.463	3.421	4.507	1.698	2.742	3.400	4.666	6.112
6	1.087	1.860	2.336	3.243	4.273	1.540	2.494	3.091	4.242	5.556
7	1.043	1.791	2.250	3.126	4.118	1.435	2.333	2.894	3.972	5.201
8	1.010	1.740	2.190	3.042	4.008	1.360	2.219	2.755	3.783	4.955
9	0.984	1.702	2.141	2.977	3.924	1.302	2.133	2.649	3.641	4.772
10	0.964	1.671	2.103	2.927	3.858	1.257	2.065	2.568	3.532	4.629
11	0.947	1.646	2.073	2.885	3.804	1.219	2.012	2.503	3.444	4.515
12	0.933	1.624	2.048	2.851	3.760	1.188	1.966	2.448	3.371	4.420
13	0.919	1.606	2.026	2.822	3.722	1.162	1.928	2.403	3.310	4.341
14	0.909	1.591	2.007	2.796	3.690	1.139	1.895	2.363	3.257	4.274
15	0.899	1.577	1.991	2.776	3.661	1.119	1.866	2.329	3.212	4.215
16	0.891	1.566	1.977	2.756	3.637	1.101	1.842	2.299	3.172	4.164
17	0.883	1.554	1.964	2.739	3.615	1.085	1.820	2.272	3.136	4.118
18	0.876	1.544	1.951	2.723	3.595	1.071	1.800	2.249	3.106	4.078
19	0.870	1.536	1.942	2.710	3.577	1.058	1.781	2.228	3.078	4.041
20	0.865	1.528	1.933	2.697	3.561	1.046	1.765	2.208	3.052	4.009
21	0.859	1.520	1.923	2.686	3.545	1.035	1.750	2.190	3.028	3.979
22	0.854	1.514	1.916	2.675	3.532	1.025	1.736	2.174	3.007	3.952
23	0.849	1.508	1.907	2.665	3.520	1.016	1.724	2.159	2.987	3.927
24	0.845	1.502	1.901	2.656	3.509	1.007	1.712	2.145	2.969	3.904
25	0.842	1.496	1.895	2.647	3.497	0.999	1.702	2.132	2.952	3.882
30	0.825	1.475	1.869	2.613	3.454	0.966	1.657	2.080	2.884	3.794
35	0.812	1.458	1.849	2.588	3.421	0.942	1.623	2.041	2.833	3.730
40	0.803	1.445	1.834	2.568	3.395	0.923	1.598	2.010	2.793	3.679
45	0.795	1.435	1.821	2.552	3.375	0.908	1.577	1.986	2.762	3.638
50	0.788	1.426	1.811	2.538	3.358	0.894	1.560	1.965	2.735	3.604

Adapted by permission from *Industrial Quality Control*, Vol. XIV, No. 10, April 1958, from article entitled "Tables for One-Sided Statistical Tolerance Limits" by G. J. Lieberman.

TABLES

TABLE A-7 (Continued). FACTORS FOR ONE-SIDED TOLERANCE LIMITS FOR NORMAL DISTRIBUTIONS

	$\gamma = 0.95$					$\gamma = 0.99$				
n \ P	0.75	0.90	0.95	0.99	0.999	0.75	0.90	0.95	0.99	0.999
3	3.804	6.158	7.655	10.552	13.857	—	—	—	—	—
4	2.619	4.163	5.145	7.042	9.215	—	—	—	—	—
5	2.149	3.407	4.202	5.741	7.501	—	—	—	—	—
6	1.895	3.006	3.707	5.062	6.612	2.849	4.408	5.409	7.334	9.540
7	1.732	2.755	3.399	4.641	6.061	2.490	3.856	4.730	6.411	8.348
8	1.617	2.582	3.188	4.353	5.686	2.252	3.496	4.287	5.811	7.566
9	1.532	2.454	3.031	4.143	5.414	2.085	3.242	3.971	5.389	7.014
10	1.465	2.355	2.911	3.981	5.203	1.954	3.048	3.739	5.075	6.603
11	1.411	2.275	2.815	3.852	5.036	1.854	2.897	3.557	4.828	6.284
12	1.366	2.210	2.736	3.747	4.900	1.771	2.773	3.410	4.633	6.032
13	1.329	2.155	2.670	3.659	4.787	1.702	2.677	3.290	4.472	5.826
14	1.296	2.108	2.614	3.585	4.690	1.645	2.592	3.189	4.336	5.651
15	1.268	2.068	2.566	3.520	4.607	1.596	2.521	3.102	4.224	5.507
16	1.242	2.032	2.523	3.463	4.534	1.553	2.458	3.028	4.124	5.374
17	1.220	2.001	2.486	3.415	4.471	1.514	2.405	2.962	4.038	5.268
18	1.200	1.974	2.453	3.370	4.415	1.481	2.357	2.906	3.961	5.167
19	1.183	1.949	2.423	3.331	4.364	1.450	2.315	2.855	3.893	5.078
20	1.167	1.926	2.396	3.295	4.319	1.424	2.275	2.807	3.832	5.003
21	1.152	1.905	2.371	3.262	4.276	1.397	2.241	2.768	3.776	4.932
22	1.138	1.887	2.350	3.233	4.238	1.376	2.208	2.729	3.727	4.866
23	1.126	1.869	2.329	3.206	4.204	1.355	2.179	2.693	3.680	4.806
24	1.114	1.853	2.309	3.181	4.171	1.336	2.154	2.663	3.638	4.755
25	1.103	1.838	2.292	3.158	4.143	1.319	2.129	2.632	3.601	4.706
30	1.059	1.778	2.220	3.064	4.022	1.249	2.029	2.516	3.446	4.508
35	1.025	1.732	2.166	2.994	3.934	1.195	1.957	2.431	3.334	4.364
40	0.999	1.697	2.126	2.941	3.866	1.154	1.902	2.365	3.250	4.255
45	0.978	1.669	2.092	2.897	3.811	1.122	1.857	2.313	3.181	4.168
50	0.961	1.646	2.065	2.863	3.766	1.096	1.821	2.296	3.124	4.096

TABLE A-8. SAMPLE SIZES REQUIRED TO DETECT PRESCRIBED DIFFERENCES BETWEEN AVERAGES WHEN THE SIGN OF THE DIFFERENCE IS NOT IMPORTANT

The table entry is the sample size (n) required to detect, with probability $1-\beta$, that the average m of a new product differs from the standard m_0 (or that two product averages m_A and m_B differ). The standardized difference is d, where

$d = \frac{|m - m_0|}{\sigma}$ (or $d = \frac{|m_A - m_B|}{\sqrt{\sigma_A^2 + \sigma_B^2}}$ if we are comparing two products).

The standard deviations are assumed to be known, and n is determined by the formula:

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{d^2}$$

$\alpha = .01$

d \ $1-\beta$	.50	.60	.70	.80	.90	.95	.99
.1	664	801	962	1168	1488	1782	2404
.2	166	201	241	292	372	446	601
.4	42	51	61	73	93	112	151
.6	19	23	27	33	42	50	67
.8	11	13	16	19	24	28	38
1.0	7	9	10	12	15	18	25
1.2	5	6	7	9	11	13	17
1.4	4	5	5	6	8	10	13
1.6	3	4	4	5	6	7	10
1.8	3	3	3	4	5	6	8
2.0	2	3	3	3	4	5	7
3.0	1	1	2	2	2	2	3

If we must estimate σ from our sample and use Student's t, then we should add 4 to the tabulated values to obtain the approximate required sample size. (If we are comparing two product averages, add 2 to the tabulated values, to obtain the required size of each sample. For this case, we must have $= \sigma_B$).

$\alpha = .05$

d \ $1-\beta$	.50	.60	.70	.80	.90	.95	.99
.1	385	490	618	785	1051	1300	1838
.2	97	123	155	197	263	325	460
.4	25	31	39	50	66	82	115
.6	11	14	18	22	30	37	52
.8	7	8	10	13	17	21	29
1.0	4	5	7	8	11	13	19
1.2	3	4	5	6	8	10	13
1.4	2	3	4	5	6	7	10
1.6	2	2	3	4	5	6	8
1.8	2	2	2	3	4	5	6
2.0	1	2	2	2	3	4	5
3.0	1	1	1	1	2	2	3

If we must estimate σ from our sample and use Student's t, then we should add 2 to the tabulated values to obtain the approximate required sample size. (If we are comparing two product averages, add 1 to the tabulated values to obtain the required size of each sample. For this case, we must have $\sigma_A = \sigma_B$.).

TABLE A-9. SAMPLE SIZES REQUIRED TO DETECT PRESCRIBED DIFFERENCES BETWEEN AVERAGES WHEN THE SIGN OF THE DIFFERENCE IS IMPORTANT

The table entry is the sample size (n) required to detect with probability $1 - \beta$ that:

(a) the average m of a new product exceeds that of a standard m_O

(b) the average m of a new product is less than that of a standard m_O

(c) the average of a specified product m_A exceeds the average of another specified product m_B.

The standardized difference is d, where:

$$\text{(a)}\quad d = \frac{m - m_O}{\sigma}$$

$$\text{(b)}\quad d = \frac{m_O - m}{\sigma}$$

$$\text{(c)}\quad d = \frac{m_A - m_B}{\sqrt{\sigma_A^2 + \sigma_B^2}}$$

The standard deviations are assumed to be known, and n is calculated from the following formula:

$$n = \frac{(z_{1-\alpha} + z_{1-\beta})^2}{d^2}$$

$\alpha = .01$

d \ $1-\beta$	.50	.60	.70	.80	.90	.95	.99
.1	542	666	813	1004	1302	1578	2165
.2	136	167	204	251	326	395	542
.4	34	42	51	63	82	99	136
.6	16	19	23	28	37	44	61
.8	9	11	13	16	21	25	34
1.0	6	7	9	11	14	16	22
1.2	4	5	6	7	10	11	16
1.4	3	4	5	6	7	9	12
1.6	3	3	4	4	6	7	9
1.8	2	3	3	4	5	5	7
2.0	2	2	3	3	4	4	6
3.0	1	1	1	2	2	2	3

If we must estimate σ from our sample, and use Student's t, add 3 to the tabulated values to obtain the approximate required sample size. (If we are comparing two product averages, add 2 to the tabulated values to obtain the required size of each sample. For this case, we must have $\sigma_A = \sigma_B$).

$\alpha = .05$

d \ $1-\beta$	.50	.60	.70	.80	.90	.95	.99
.1	271	361	471	619	857	1083	1578
.2	68	91	118	155	215	271	395
.4	17	23	30	39	54	68	99
.6	8	11	14	18	24	31	44
.8	5	6	8	10	14	17	25
1.0	3	4	5	7	9	11	16
1.2	2	3	4	5	6	8	11
1.4	2	2	3	4	5	6	9
1.6	2	2	2	3	4	5	7
1.8	1	2	2	2	3	4	5
2.0	1	1	2	2	3	3	4
3.0	1	1	1	1	1	2	2

If we must estimate σ from our sample, and use Student's t, add 2 to the tabulated values to obtain the approximate required sample size. (If we are comparing two product averages, add 1 to the tabulated values to obtain the required size of each sample. For this case, we must have $\sigma_A = \sigma_B$).

TABLE A-10. PERCENTILES OF THE STUDENTIZED RANGE, q

$q = w/s$ where w is the range of t observations, and ν is the number of degrees of freedom associated with the standard deviation s.

$q_{.90}$

ν \ t	2	3	4	5	6	7	8	9	10
1	8.93	13.44	16.36	18.49	20.15	21.51	22.64	23.62	24.48
2	4.13	5.73	6.77	7.54	8.14	8.63	9.05	9.41	9.72
3	3.33	4.47	5.20	5.74	6.16	6.51	6.81	7.06	7.29
4	3.01	3.98	4.59	5.03	5.39	5.68	5.93	6.14	6.33
5	2.85	3.72	4.26	4.66	4.98	5.24	5.46	5.65	5.82
6	2.75	3.56	4.07	4.44	4.73	4.97	5.17	5.34	5.50
7	2.68	3.45	3.93	4.28	4.55	4.78	4.97	5.14	5.28
8	2.63	3.37	3.83	4.17	4.43	4.65	4.83	4.99	5.13
9	2.59	3.32	3.76	4.08	4.34	4.54	4.72	4.87	5.01
10	2.56	3.27	3.70	4.02	4.26	4.47	4.64	4.78	4.91
11	2.54	3.23	3.66	3.96	4.20	4.40	4.57	4.71	4.84
12	2.52	3.20	3.62	3.92	4.16	4.35	4.51	4.65	4.78
13	2.50	3.18	3.59	3.88	4.12	4.30	4.46	4.60	4.72
14	2.49	3.16	3.56	3.85	4.08	4.27	4.42	4.56	4.68
15	2.48	3.14	3.54	3.83	4.05	4.23	4.39	4.52	4.64
16	2.47	3.12	3.52	3.80	4.03	4.21	4.36	4.49	4.61
17	2.46	3.11	3.50	3.78	4.00	4.18	4.33	4.46	4.58
18	2.45	3.10	3.49	3.77	3.98	4.16	4.31	4.44	4.55
19	2.45	3.09	3.47	3.75	3.97	4.14	4.29	4.42	4.53
20	2.44	3.08	3.46	3.74	3.95	4.12	4.27	4.40	4.51
24	2.42	3.05	3.42	3.69	3.90	4.07	4.21	4.34	4.44
30	2.40	3.02	3.39	3.65	3.85	4.02	4.16	4.28	4.38
40	2.38	2.99	3.35	3.60	3.80	3.96	4.10	4.21	4.32
60	2.36	2.96	3.31	3.56	3.75	3.91	4.04	4.16	4.25
120	2.34	2.93	3.28	3.52	3.71	3.86	3.99	4.10	4.19
∞	2.33	2.90	3.24	3.48	3.66	3.81	3.93	4.04	4.13

Adapted by permission from *Biometrika*, Vol. 46, Dec. 1959, from article entitled "Tables of the Upper 10% Points of the Studentized Range (Accompanied by Revised Tables of 5% and 1% Points)," by James Pachares.

TABLE A-10 (Continued). PERCENTILES OF THE STUDENTIZED RANGE, q

$q_{.90}$

ν \ t	11	12	13	14	15	16	17	18	19	20
1	25.24	25.92	26.54	27.10	27.62	28.10	28.54	28.96	29.35	29.71
2	10.01	10.26	10.49	10.70	10.89	11.07	11.24	11.39	11.54	11.68
3	7.49	7.67	7.83	7.98	8.12	8.25	8.37	8.48	8.58	8.68
4	6.49	6.65	6.78	6.91	7.02	7.13	7.23	7.33	7.41	7.50
5	5.97	6.10	6.22	6.34	6.44	6.54	6.63	6.71	6.79	6.86
6	5.64	5.76	5.87	5.98	6.07	6.16	6.25	6.32	6.40	6.47
7	5.41	5.53	5.64	5.74	5.83	5.91	5.99	6.06	6.13	6.19
8	5.25	5.36	5.46	5.56	5.64	5.72	5.80	5.87	5.93	6.00
9	5.13	5.23	5.33	5.42	5.51	5.58	5.66	5.72	5.79	5.85
10	5.03	5.13	5.23	5.32	5.40	5.47	5.54	5.61	5.67	5.73
11	4.95	5.05	5.15	5.23	5.31	5.38	5.45	5.51	5.57	5.63
12	4.89	4.99	5.08	5.16	5.24	5.31	5.37	5.44	5.49	5.55
13	4.83	4.93	5.02	5.10	5.18	5.25	5.31	5.37	5.43	5.48
14	4.79	4.88	4.97	5.05	5.12	5.19	5.26	5.32	5.37	5.43
15	4.75	4.84	4.93	5.01	5.08	5.15	5.21	5.27	5.32	5.38
16	4.71	4.81	4.89	4.97	5.04	5.11	5.17	5.23	5.28	5.33
17	4.68	4.77	4.86	4.93	5.01	5.07	5.13	5.19	5.24	5.30
18	4.65	4.75	4.83	4.90	4.98	5.04	5.10	5.16	5.21	5.26
19	4.63	4.72	4.80	4.88	4.95	5.01	5.07	5.13	5.18	5.23
20	4.61	4.70	4.78	4.85	4.92	4.99	5.05	5.10	5.16	5.20
24	4.54	4.63	4.71	4.78	4.85	4.91	4.97	5.02	5.07	5.12
30	4.47	4.56	4.64	4.71	4.77	4.83	4.89	4.94	4.99	5.03
40	4.41	4.49	4.56	4.63	4.69	4.75	4.81	4.86	4.90	4.95
60	4.34	4.42	4.49	4.56	4.62	4.67	4.73	4.78	4.82	4.86
120	4.28	4.35	4.42	4.48	4.54	4.60	4.65	4.69	4.74	4.78
∞	4.21	4.28	4.35	4.41	4.47	4.52	4.57	4.61	4.65	4.69

TABLE A-10 (Continued). PERCENTILES OF THE STUDENTIZED RANGE, q

$q_{.95}$

ν \ t	2	3	4	5	6	7	8	9	10
1	17.97	26.98	32.82	37.08	40.41	43.12	45.40	47.36	49.07
2	6.08	8.33	9.80	10.88	11.74	12.44	13.03	13.54	13.99
3	4.50	5.91	6.82	7.50	8.04	8.48	8.85	9.18	9.46
4	3.93	5.04	5.76	6.29	6.71	7.05	7.35	7.60	7.83
5	3.64	4.60	5.22	5.67	6.03	6.33	6.58	6.80	6.99
6	3.46	4.34	4.90	5.30	5.63	5.90	6.12	6.32	6.49
7	3.34	4.16	4.68	5.06	5.36	5.61	5.82	6.00	6.16
8	3.26	4.04	4.53	4.89	5.17	5.40	5.60	5.77	5.92
9	3.20	3.95	4.41	4.76	5.02	5.24	5.43	5.59	5.74
10	3.15	3.88	4.33	4.65	4.91	5.12	5.30	5.46	5.60
11	3.11	3.82	4.26	4.57	4.82	5.03	5.20	5.35	5.49
12	3.08	3.77	4.20	4.51	4.75	4.95	5.12	5.27	5.39
13	3.06	3.73	4.15	4.45	4.69	4.88	5.05	5.19	5.32
14	3.03	3.70	4.11	4.41	4.64	4.83	4.99	5.13	5.25
15	3.01	3.67	4.08	4.37	4.59	4.78	4.94	5.08	5.20
16	3.00	3.65	4.05	4.33	4.56	4.74	4.90	5.03	5.15
17	2.98	3.63	4.02	4.30	4.52	4.70	4.86	4.99	5.11
18	2.97	3.61	4.00	4.28	4.49	4.67	4.82	4.96	5.07
19	2.96	3.59	3.98	4.25	4.47	4.65	4.79	4.92	5.04
20	2.95	3.58	3.96	4.23	4.45	4.62	4.77	4.90	5.01
24	2.92	3.53	3.90	4.17	4.37	4.54	4.68	4.81	4.92
30	2.89	3.49	3.85	4.10	4.30	4.46	4.60	4.72	4.82
40	2.86	3.44	3.79	4.04	4.23	4.39	4.52	4.63	4.73
60	2.83	3.40	3.74	3.98	4.16	4.31	4.44	4.55	4.65
120	2.80	3.36	3.68	3.92	4.10	4.24	4.36	4.47	4.56
∞	2.77	3.31	3.63	3.86	4.03	4.17	4.29	4.39	4.47

TABLE A-10 (Continued). PERCENTILES OF THE STUDENTIZED RANGE, q

$q_{.95}$

ν \ t	11	12	13	14	15	16	17	18	19	20
1	50.59	51.96	53.20	54.33	55.36	56.32	57.22	58.04	58.83	59.56
2	14.39	14.75	15.08	15.38	15.65	15.91	16.14	16.37	16.57	16.77
3	9.72	9.95	10.15	10.35	10.52	10.69	10.84	10.98	11.11	11.24
4	8.03	8.21	8.37	8.52	8.66	8.79	8.91	9.03	9.13	9.23
5	7.17	7.32	7.47	7.60	7.72	7.83	7.93	8.03	8.12	8.21
6	6.65	6.79	6.92	7.03	7.14	7.24	7.34	7.43	7.51	7.59
7	6.30	6.43	6.55	6.66	6.76	6.85	6.94	7.02	7.10	7.17
8	6.05	6.18	6.29	6.39	6.48	6.57	6.65	6.73	6.80	6.87
9	5.87	5.98	6.09	6.19	6.28	6.36	6.44	6.51	6.58	6.64
10	5.72	5.83	5.93	6.03	6.11	6.19	6.27	6.34	6.40	6.47
11	5.61	5.71	5.81	5.90	5.98	6.06	6.13	6.20	6.27	6.33
12	5.51	5.61	5.71	5.80	5.88	5.95	6.02	6.09	6.15	6.21
13	5.43	5.53	5.63	5.71	5.79	5.86	5.93	5.99	6.05	6.11
14	5.36	5.46	5.55	5.64	5.71	5.79	5.85	5.91	5.97	6.03
15	5.31	5.40	5.49	5.57	5.65	5.72	5.78	5.85	5.90	5.96
16	5.26	5.35	5.44	5.52	5.59	5.66	5.73	5.79	5.84	5.90
17	5.21	5.31	5.39	5.47	5.54	5.61	5.67	5.73	5.79	5.84
18	5.17	5.27	5.35	5.43	5.50	5.57	5.63	5.69	5.74	5.79
19	5.14	5.23	5.31	5.39	5.46	5.53	5.59	5.65	5.70	5.75
20	5.11	5.20	5.28	5.36	5.43	5.49	5.55	5.61	5.66	5.71
24	5.01	5.10	5.18	5.25	5.32	5.38	5.44	5.49	5.55	5.59
30	4.92	5.00	5.08	5.15	5.21	5.27	5.33	5.38	5.43	5.47
40	4.82	4.90	4.98	5.04	5.11	5.16	5.22	5.27	5.31	5.36
60	4.73	4.81	4.88	4.94	5.00	5.06	5.11	5.15	5.20	5.24
120	4.64	4.71	4.78	4.84	4.90	4.95	5.00	5.04	5.09	5.13
∞	4.55	4.62	4.68	4.74	4.80	4.85	4.89	4.93	4.97	5.01

TABLE A-10 (Continued). PERCENTILES OF THE STUDENTIZED RANGE, q

$q_{.99}$

ν \ t	2	3	4	5	6	7	8	9	10
1	90.03	135.0	164.3	185.6	202.2	215.8	227.2	237.0	245.6
2	14.04	19.02	22.29	24.72	26.63	28.20	29.53	30.68	31.69
3	8.26	10.62	12.17	13.33	14.24	15.00	15.64	16.20	16.69
4	6.51	8.12	9.17	9.96	10.58	11.10	11.55	11.93	12.27
5	5.70	6.98	7.80	8.42	8.91	9.32	9.67	9.97	10.24
6	5.24	6.33	7.03	7.56	7.97	8.32	8.61	8.87	9.10
7	4.95	5.92	6.54	7.01	7.37	7.68	7.94	8.17	8.37
8	4.75	5.64	6.20	6.62	6.96	7.24	7.47	7.68	7.86
9	4.60	5.43	5.96	6.35	6.66	6.91	7.13	7.33	7.49
10	4.48	5.27	5.77	6.14	6.43	6.67	6.87	7.05	7.21
11	4.39	5.15	5.62	5.97	6.25	6.48	6.67	6.84	6.99
12	4.32	5.05	5.50	5.84	6.10	6.32	6.51	6.67	6.81
13	4.26	4.96	5.40	5.73	5.98	6.19	6.37	6.53	6.67
14	4.21	4.89	5.32	5.63	5.88	6.08	6.26	6.41	6.54
15	4.17	4.84	5.25	5.56	5.80	5.99	6.16	6.31	6.44
16	4.13	4.79	5.19	5.49	5.72	5.92	6.08	6.22	6.35
17	4.10	4.74	5.14	5.43	5.66	5.85	6.01	6.15	6.27
18	4.07	4.70	5.09	5.38	5.60	5.79	5.94	6.08	6.20
19	4.05	4.67	5.05	5.33	5.55	5.73	5.89	6.02	6.14
20	4.02	4.64	5.02	5.29	5.51	5.69	5.84	5.97	6.09
24	3.96	4.55	4.91	5.17	5.37	5.54	5.69	5.81	5.92
30	3.89	4.45	4.80	5.05	5.24	5.40	5.54	5.65	5.76
40	3.82	4.37	4.70	4.93	5.11	5.26	5.39	5.50	5.60
60	3.76	4.28	4.59	4.82	4.99	5.13	5.25	5.36	5.45
120	3.70	4.20	4.50	4.71	4.87	5.01	5.12	5.21	5.30
∞	3.64	4.12	4.40	4.60	4.76	4.88	4.99	5.08	5.16

TABLE A-10 (Continued). PERCENTILES OF THE STUDENTIZED RANGE, q

$q_{.99}$

ν \ t	11	12	13	14	15	16	17	18	19	20
1	253.2	260.0	266.2	271.8	277.0	281.8	286.3	290.4	294.3	298.0
2	32.59	33.40	34.13	34.81	35.43	36.00	36.53	37.03	37.50	37.95
3	17.13	17.53	17.89	18.22	18.52	18.81	19.07	19.32	19.55	19.77
4	12.57	12.84	13.09	13.32	13.53	13.73	13.91	14.08	14.24	14.40
5	10.48	10.70	10.89	11.08	11.24	11.40	11.55	11.68	11.81	11.93
6	9.30	9.48	9.65	9.81	9.95	10.08	10.21	10.32	10.43	10.54
7	8.55	8.71	8.86	9.00	9.12	9.24	9.35	9.46	9.55	9.65
8	8.03	8.18	8.31	8.44	8.55	8.66	8.76	8.85	8.94	9.03
9	7.65	7.78	7.91	8.03	8.13	8.23	8.33	8.41	8.49	8.57
10	7.36	7.49	7.60	7.71	7.81	7.91	7.99	8.08	8.15	8.23
11	7.13	7.25	7.36	7.46	7.56	7.65	7.73	7.81	7.88	7.95
12	6.94	7.06	7.17	7.26	7.36	7.44	7.52	7.59	7.66	7.73
13	6.79	6.90	7.01	7.10	7.19	7.27	7.35	7.42	7.48	7.55
14	6.66	6.77	6.87	6.96	7.05	7.13	7.20	7.27	7.33	7.39
15	6.55	6.66	6.76	6.84	6.93	7.00	7.07	7.14	7.20	7.26
16	6.46	6.56	6.66	6.74	6.82	6.90	6.97	7.03	7.09	7.15
17	6.38	6.48	6.57	6.66	6.73	6.81	6.87	6.94	7.00	7.05
18	6.31	6.41	6.50	6.58	6.65	6.73	6.79	6.85	6.91	6.97
19	6.25	6.34	6.43	6.51	6.58	6.65	6.72	6.78	6.84	6.89
20	6.19	6.28	6.37	6.45	6.52	6.59	6.65	6.71	6.77	6.82
24	6.02	6.11	6.19	6.26	6.33	6.39	6.45	6.51	6.56	6.61
30	5.85	5.93	6.01	6.08	6.14	6.20	6.26	6.31	6.36	6.41
40	5.69	5.76	5.83	5.90	5.96	6.02	6.07	6.12	6.16	6.21
60	5.53	5.60	5.67	5.73	5.78	5.84	5.89	5.93	5.97	6.01
120	5.37	5.44	5.50	5.56	5.61	5.66	5.71	5.75	5.79	5.83
∞	5.23	5.29	5.35	5.40	5.45	5.49	5.54	5.57	5.61	5.65

TABLE A-11. PERCENTILES OF $F' = \frac{w_A}{w_B}$

n_B	Cum. Prop.	n_A = 2	3	4	5	6	7	8	9	10
2	.005	.0078	.096	.21	.30	.38	.44	.49	.54	.57
	.01	.0157	.136	.26	.38	.46	.53	.59	.64	.68
	.025	.039	.217	.37	.50	.60	.68	.74	.79	.83
	.05	.079	.31	.50	.62	.74	.80	.86	.91	.95
	.95	12.7	19.1	23	26	29	30	32	34	35
	.975	25.5	38.2	52	57	60	62	64	67	68
	.99	63.7	95	116	132	142	153	160	168	174
	.995	127	191	230	250	260	270	280	290	290
3	.005	.0052	.071	.16	.24	.32	.38	.43	.47	.50
	.01	.0105	.100	.20	.30	.37	.43	.49	.53	.57
	.025	.026	.160	.28	.39	.47	.54	.59	.64	.68
	.05	.052	.23	.37	.49	.57	.64	.70	.75	.80
	.95	3.19	4.4	5.0	5.7	6.2	6.6	6.9	7.2	7.4
	.975	4.61	6.3	7.3	8.0	8.7	9.3	9.8	10.2	10.5
	.99	7.37	10	12	13	14	15	15	16	17
	.995	10.4	14	17	18	20	21	22	23	25
4	.005	.0043	.059	.14	.22	.28	.34	.39	.43	.46
	.01	.0086	.084	.18	.26	.33	.39	.44	.48	.52
	.025	.019	.137	.25	.34	.42	.48	.53	.57	.61
	.05	.043	.20	.32	.42	.50	.57	.62	.67	.70
	.95	2.02	2.7	3.1	3.4	3.6	3.8	4.0	4.2	4.4
	.975	2.72	3.5	4.0	4.4	4.7	5.0	5.2	5.4	5.6
	.99	3.83	5.0	5.5	6.0	6.4	6.7	7.0	7.2	7.5
	.995	4.85	6.1	7.0	7.6	8.1	8.5	8.8	9.3	9.6
5	.005	.0039	.054	.13	.20	.26	.32	.36	.40	.44
	.01	.0076	.079	.17	.24	.31	.36	.41	.45	.49
	.025	.018	.124	.23	.32	.38	.44	.49	.53	.57
	.05	.038	.18	.29	.40	.46	.52	.57	.61	.65
	.95	1.61	2.1	2.4	2.6	2.8	2.9	3.0	3.1	3.2
	.975	2.01	2.6	2.9	3.2	3.4	3.6	3.7	3.8	3.9
	.99	2.64	3.4	3.8	4.1	4.3	4.6	4.7	4.9	5.0
	.995	3.36	4.1	4.6	4.9	5.2	5.5	5.7	5.9	6.1

TABLE A-11 (Continued). PERCENTILES OF $F' = \frac{w_A}{w_B}$

n_B	Cum. Prop.	n_A 2	3	4	5	6	7	8	9	10
6	.005	.0038	.051	.12	.19	.25	.30	.35	.38	.42
	.01	.0070	.073	.16	.23	.29	.34	.39	.43	.46
	.025	.017	.115	.21	.30	.36	.42	.46	.50	.54
	.05	.035	.16	.27	.36	.43	.49	.54	.58	.61
	.95	1.36	1.8	2.0	2.2	2.3	2.4	2.5	2.6	2.7
	.975	1.67	2.1	2.4	2.6	2.8	2.9	3.0	3.1	3.2
	.99	2.16	2.7	3.0	3.2	3.4	3.6	3.7	3.8	3.9
	.995	2.67	3.1	3.5	3.8	4.0	4.1	4.3	4.5	4.6
7	.005	.0037	.048	.12	.18	.24	.29	.33	.37	.40
	.01	.0066	.069	.15	.22	.28	.33	.37	.41	.45
	.025	.016	.107	.20	.28	.34	.40	.44	.48	.52
	.05	.032	.15	.26	.35	.41	.47	.51	.55	.59
	.95	1.26	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4
	.975	1.48	1.9	2.1	2.3	2.4	2.5	2.6	2.7	2.8
	.99	1.87	2.3	2.6	2.8	2.9	3.0	3.1	3.2	3.3
	.995	2.28	2.7	2.9	3.1	3.3	3.5	3.6	3.7	3.8
8	.005	.0036	.045	.11	.18	.23	.28	.32	.36	.39
	.01	.0063	.065	.14	.21	.27	.32	.36	.40	.43
	.025	.016	.102	.19	.27	.33	.38	.43	.47	.50
	.05	.031	.14	.25	.33	.40	.45	.50	.53	.57
	.95	1.17	1.4	1.6	1.8	1.9	1.9	2.0	2.1	2.1
	.975	1.36	1.7	1.9	2.0	2.2	2.3	2.3	2.4	2.5
	.99	1.69	2.1	2.3	2.4	2.6	2.7	2.8	2.8	2.9
	.995	2.03	2.3	2.6	2.7	2.9	3.0	3.1	3.2	3.3
9	.005	.0035	.042	.11	.17	.22	.27	.31	.35	.38
	.01	.0060	.062	.14	.21	.26	.31	.35	.39	.42
	.025	.015	.098	.18	.26	.32	.37	.42	.46	.49
	.05	.030	.14	.24	.32	.38	.44	.48	.52	.55
	.95	1.10	1.3	1.5	1.6	1.7	1.8	1.9	1.9	2.0
	.975	1.27	1.6	1.8	1.9	2.0	2.1	2.1	2.2	2.3
	.99	1.56	1.9	2.1	2.2	2.3	2.4	2.5	2.6	2.6
	.995	1.87	2.1	2.3	2.5	2.6	2.7	2.8	2.9	3.0
10	.005	.0034	.041	.10	.16	.22	.26	.30	.34	.37
	.01	.0058	.060	.13	.20	.26	.30	.34	.38	.41
	.025	.015	.095	.18	.25	.31	.36	.41	.44	.48
	.05	.029	.13	.23	.31	.37	.43	.47	.51	.54
	.95	1.05	1.8	1.4	1.5	1.6	1.7	1.8	1.8	1.9
	.975	1.21	1.5	1.6	1.8	1.9	1.9	2.0	2.0	2.1
	.99	1.47	1.8	1.9	2.1	2.2	2.2	2.3	2.4	2.4
	.995	1.75	2.0	2.2	2.3	2.4	2.5	2.6	2.6	2.7

TABLE A-12. PERCENTILES FOR $\phi = \dfrac{\bar{X} - m_0}{w}$

Sample Size	$\phi_{.95}$	$\phi_{.975}$	$\phi_{.99}$	$\phi_{.995}$	$\phi_{.999}$	$\phi_{.9995}$
2	3.175	6.353	15.910	31.828	159.16	318.31
3	.885	1.304	2.111	3.008	6.77	9.58
4	.529	.717	1.023	1.316	2.29	2.85
5	.388	.507	.685	.843	1.32	1.58
6	.312	.399	.523	.628	.92	1.07
7	.263	.383	.429	.507	.71	.82
8	.230	.288	.366	.429	.59	.67
9	.205	.255	.322	.374	.50	.57
10	.186	.230	.288	.333	.44	.50
11	.170	.210	.262	.302	.40	.44
12	.158	.194	.241	.277	.36	.40
13	.147	.181	.224	.256	.33	.37
14	.138	.170	.209	.239	.31	.34
15	.131	.160	.197	.224	.29	.32
16	.124	.151	.186	.212	.27	.30
17	.118	.144	.177	.201	.26	.28
18	.113	.137	.168	.191	.24	.26
19	.108	.131	.161	.182	.23	.25
20	.104	.126	.154	.175	.22	.24

Adapted with permission from *Biometrika*, Vol. 34 (1947) from article entitled "The Use of the Range in Place of the Standard Deviation in the *t* Test" by E. Lord.

TABLE A-13. PERCENTILES FOR $\phi' = \dfrac{\bar{X}_A - \bar{X}_B}{\frac{1}{2}(w_A + w_B)}$

$n = n_A = n_B$	$\phi'_{.95}$	$\phi'_{.975}$	$\phi'_{.99}$	$\phi'_{.995}$	$\phi'_{.999}$	$\phi'_{.9995}$
2	2.322	3.427	5.553	7.916	17.81	25.23
3	.974	1.272	1.715	2.093	3.27	4.18
4	.644	.813	1.047	1.237	1.74	1.99
5	.493	.613	.772	.896	1.21	1.35
6	.405	.499	.621	.714	.94	1.03
7	.347	.426	.525	.600	.77	.85
8	.306	.373	.459	.521	.67	.73
9	.275	.334	.409	.464	.59	.64
10	.250	.304	.371	.419	.53	.58
11	.233	.280	.340	.384	.48	.52
12	.214	.260	.315	.355	.44	.48
13	.201	.243	.294	.331	.41	.45
14	.189	.228	.276	.311	.39	.42
15	.179	.216	.261	.293	.36	.39
16	.170	.205	.247	.278	.34	.37
17	.162	.195	.236	.264	.33	.35
18	.155	.187	.225	.252	.31	.34
19	.149	.179	.216	.242	.30	.32
20	.143	.172	.207	.232	.29	.31

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TABLE A-14. CRITERIA FOR REJECTION OF OUTLYING OBSERVATIONS

Statistic	Number of Observations, n	Upper Percentiles						
		.70	.80	.90	.95	.98	.99	.995
r_{10}	3	.684	.781	.886	.941	.976	.988	.994
	4	.471	.560	.679	.765	.846	.889	.926
	5	.373	.451	.557	.642	.729	.780	.821
	6	.318	.386	.482	.560	.644	.698	.740
	7	.281	.344	.434	.507	.586	.637	.680
r_{11}	8	.318	.385	.479	.554	.631	.683	.725
	9	.288	.352	.441	.512	.587	.635	.677
	10	.265	.325	.409	.477	.551	.597	.639
r_{21}	11	.391	.442	.517	.576	.638	.679	.713
	12	.370	.419	.490	.546	.605	.642	.675
	13	.351	.399	.467	.521	.578	.615	.649
r_{22}	14	.370	.421	.492	.546	.602	.641	.674
	15	.353	.402	.472	.525	.579	.616	.647
	16	.338	.386	.454	.507	.559	.595	.624
	17	.325	.373	.438	.490	.542	.577	.605
	18	.314	.361	.424	.475	.527	.561	.589
	19	.304	.350	.412	.462	.514	.547	.575
	20	.295	.340	.401	.450	.502	.535	.562
	21	.287	.331	.391	.440	.491	.524	.551
	22	.280	.323	.382	.430	.481	.514	.541
	23	.274	.316	.374	.421	.472	.505	.532
	24	.268	.310	.367	.413	.464	.497	.524
	25	.262	.304	.360	.406	.457	.489	.516

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TABLE A-15. CRITICAL VALUES OF L FOR LINK-WALLACE TEST

$\alpha = .05$

t = number of groups = number of ranges

n = number in group = number per range

n \ t	2	3	4	5	6	7	8	9	10
2	3.43	2.37	1.78	1.40	1.16	1.00	.87	.78	.70
3	1.91	1.44	1.13	.94	.80	.70	.62	.56	.51
4	1.63	1.25	1.01	.84	.72	.63	.57	.51	.47
5	1.53	1.19	.96	.81	.70	.61	.55	.50	.45
6	1.50	1.18	.95	.80	.69	.61	.55	.49	.45
7	1.49	1.17	.95	.80	.69	.61	.55	.50	.45
8	1.49	1.17	.96	.81	.70	.62	.55	.50	.46
9	1.50	1.18	.97	.82	.71	.62	.56	.51	.47
10	1.52	1.20	.98	.83	.72	.63	.57	.52	.47
11	1.54	1.21	.99	.84	.73	.64	.58	.52	.48
12	1.56	1.23	1.00	.85	.74	.65	.59	.53	.49
13	1.58	1.25	1.02	.86	.75	.66	.59	.54	.49
14	1.60	1.26	1.03	.87	.76	.67	.60	.55	.50
15	1.62	1.28	1.05	.89	.77	.68	.61	.56	.51
16	1.64	1.30	1.06	.90	.78	.69	.62	.56	.52
17	1.66	1.31	1.08	.91	.79	.70	.63	.57	.52
18	1.68	1.33	1.09	.92	.80	.71	.64	.58	.53
19	1.70	1.34	1.10	.93	.81	.72	.65	.59	.54
20	1.72	1.36	1.11	.95	.82	.73	.65	.59	.54

n \ t	11	12	13	14	15	16	17	18	19	20
2	.66	.63	.58	.50	.47	.44	.42	.40	.38	.36
3	.47	.43	.40	.38	.36	.33	.32	.30	.29	.27
4	.43	.40	.37	.35	.33	.31	.29	.28	.27	.25
5	.42	.39	.36	.34	.32	.30	.29	.27	.26	.25
6	.42	.39	.36	.34	.32	.30	.29	.27	.26	.25
7	.42	.39	.36	.34	.32	.30	.29	.28	.26	.25
8	.42	.39	.37	.35	.33	.31	.29	.28	.27	.25
9	.43	.40	.37	.35	.33	.31	.30	.28	.27	.26
10	.44	.41	.38	.35	.34	.32	.30	.29	.27	.26
11	.44	.41	.38	.36	.34	.32	.31	.29	.28	.27
12	.45	.42	.39	.37	.35	.33	.31	.30	.28	.27
13	.46	.42	.40	.37	.35	.33	.32	.30	.29	.27
14	.46	.43	.40	.38	.36	.34	.32	.31	.29	.28
15	.47	.44	.41	.38	.36	.34	.33	.31	.30	.28
16	.48	.44	.41	.39	.37	.35	.33	.31	.30	.29
17	.48	.45	.42	.39	.37	.35	.33	.32	.30	.29
18	.49	.46	.43	.40	.38	.36	.34	.32	.31	.30
19	.50	.46	.43	.40	.38	.36	.34	.33	.31	.30
20	.50	.47	.44	.41	.39	.37	.35	.33	.32	.30

Adapted by permission from "Some Short Cuts to Allowances," Table 1, by R. F. Link and D. L. Wallace, Princeton University, (unpublished manuscript).

TABLE A-15 (Continued). CRITICAL VALUES OF *L* FOR LINK-WALLACE TEST

$\alpha = .01$

t = number of groups = number of ranges

n = number in group = number per range

n \ t	2	3	4	5	6	7	8	9	10
2	7.92	4.42	2.96	2.06	1.69	1.39	1.20	1.03	.91
3	3.14	2.14	1.57	1.25	1.04	.89	.78	.69	.62
4	2.47	1.74	1.33	1.08	.91	.78	.69	.62	.56
5	2.24	1.60	1.24	1.02	.86	.75	.66	.59	.54
6	2.14	1.55	1.21	.99	.85	.74	.65	.59	.53
7	2.10	1.53	1.21	.99	.84	.74	.65	.59	.53
8	2.08	1.52	1.21	.99	.85	.74	.66	.59	.54
9	2.09	1.53	1.22	1.00	.85	.75	.66	.60	.54
10	2.10	1.55	1.23	1.01	.86	.75	.67	.61	.55
11	2.11	1.56	1.24	1.02	.88	.77	.68	.61	.56
12	2.13	1.58	1.25	1.03	.89	.78	.69	.62	.57
13	2.15	1.60	1.27	1.05	.90	.79	.70	.63	.58
14	2.18	1.62	1.28	1.06	.91	.80	.71	.64	.58
15	2.20	1.64	1.30	1.08	.92	.81	.72	.65	.59
16	2.22	1.65	1.31	1.09	.93	.82	.73	.66	.60
17	2.24	1.67	1.33	1.11	.95	.83	.74	.67	.61
18	2.27	1.69	1.34	1.12	.96	.84	.75	.68	.62
19	2.30	1.71	1.36	1.14	.97	.85	.76	.68	.62
20	2.32	1.73	1.38	1.15	.98	.86	.77	.69	.63

n \ t	11	12	13	14	15	16	17	18	19	20
2	.82	.75	.68	.63	.59	.55	.51	.48	.46	.43
3	.57	.52	.48	.45	.42	.39	.37	.35	.34	.32
4	.51	.47	.44	.41	.38	.36	.34	.32	.31	.29
5	.49	.46	.42	.40	.37	.35	.33	.31	.30	.29
6	.49	.45	.42	.39	.37	.35	.33	.31	.30	.28
7	.49	.45	.42	.40	.37	.35	.33	.32	.30	.29
8	.50	.46	.43	.40	.37	.35	.33	.32	.30	.29
9	.50	.46	.43	.40	.38	.36	.34	.32	.31	.29
10	.51	.47	.44	.41	.38	.36	.34	.33	.31	.30
11	.51	.48	.44	.42	.39	.37	.35	.33	.32	.30
12	.52	.48	.45	.42	.40	.37	.35	.34	.32	.31
13	.53	.49	.46	.43	.40	.38	.36	.34	.33	.31
14	.54	.50	.46	.43	.41	.39	.37	.35	.33	.32
15	.54	.50	.47	.44	.41	.39	.37	.35	.34	.32
16	.55	.51	.48	.45	.42	.40	.38	.36	.34	.32
17	.56	.52	.48	.45	.43	.40	.38	.36	.34	.33
18	.57	.53	.49	.46	.43	.41	.39	.37	.35	.33
19	.57	.53	.50	.46	.44	.41	.39	.37	.35	.34
20	.58	.54	.50	.47	.44	.42	.40	.38	.36	.34

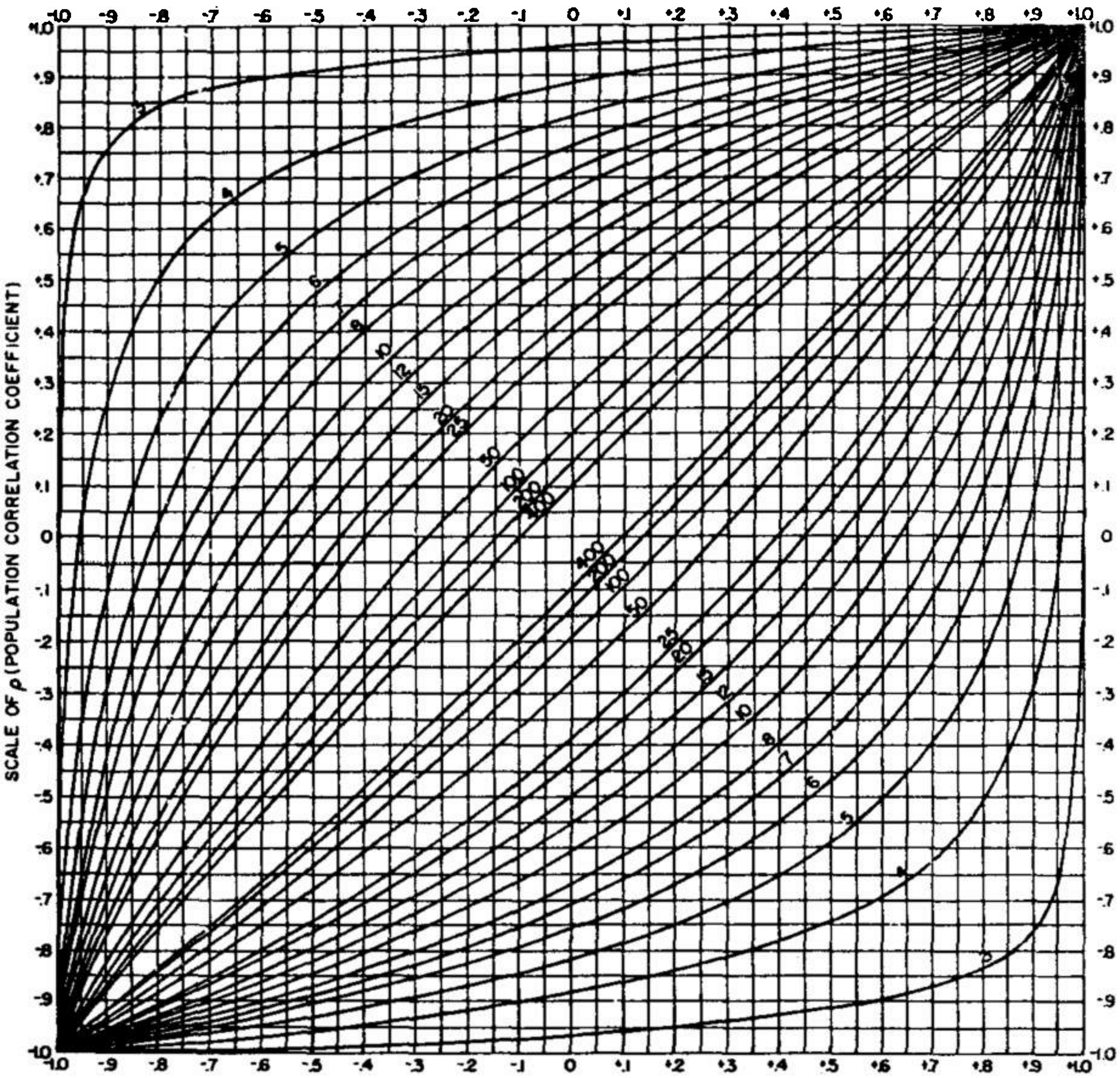
TABLE A-16. PERCENTAGE POINTS OF THE EXTREME STUDENTIZED DEVIATE FROM SAMPLE MEAN,

$$t_n = (X_n - \bar{X})/s_\nu \text{ (or) } t_1 = (\bar{X} - X_1)/s_\nu$$

This table is to be used with s_ν, an *external* estimate of σ, based on ν degrees of freedom, not with the s computed from the sample in hand.

ν \ n	α = .05								α = .01							
	3	4	5	6	7	8	9	12	3	4	5	6	7	8	9	12
10	2.01	2.27	2.46	2.60	2.72	2.81	2.89	3.08	2.78	3.10	3.32	3.48	3.62	3.73	3.82	4.04
11	1.98	2.24	2.42	2.56	2.67	2.76	2.84	3.03	2.72	3.02	3.24	3.39	3.52	3.63	3.72	3.93
12	1.96	2.21	2.39	2.52	2.63	2.72	2.80	2.98	2.67	2.96	3.17	3.32	3.45	3.55	3.64	3.84
13	1.94	2.19	2.36	2.50	2.60	2.69	2.76	2.94	2.63	2.92	3.12	3.27	3.38	3.48	3.57	3.76
14	1.93	2.17	2.34	2.47	2.57	2.66	2.74	2.91	2.60	2.88	3.07	3.22	3.33	3.43	3.51	3.70
15	1.91	2.15	2.32	2.45	2.55	2.64	2.71	2.88	2.57	2.84	3.03	3.17	3.29	3.38	3.46	3.65
16	1.90	2.14	2.31	2.43	2.53	2.62	2.69	2.86	2.54	2.81	3.00	3.14	3.25	3.34	3.42	3.60
17	1.89	2.13	2.29	2.42	2.52	2.60	2.67	2.84	2.52	2.79	2.97	3.11	3.22	3.31	3.38	3.56
18	1.88	2.11	2.28	2.40	2.50	2.58	2.65	2.82	2.50	2.77	2.95	3.08	3.19	3.28	3.35	3.53
19	1.87	2.11	2.27	2.39	2.49	2.57	2.64	2.80	2.49	2.75	2.93	3.06	3.16	3.25	3.33	3.50
20	1.87	2.10	2.26	2.38	2.47	2.56	2.63	2.78	2.47	2.73	2.91	3.04	3.14	3.23	3.30	3.47
24	1.84	2.07	2.23	2.34	2.44	2.52	2.58	2.74	2.42	2.68	2.84	2.97	3.07	3.16	3.23	3.38
30	1.82	2.04	2.20	2.31	2.40	2.48	2.54	2.69	2.38	2.62	2.79	2.91	3.01	3.08	3.15	3.30
40	1.80	2.02	2.17	2.28	2.37	2.44	2.50	2.65	2.34	2.57	2.73	2.85	2.94	3.02	3.08	3.22
60	1.78	1.99	2.14	2.25	2.33	2.41	2.47	2.61	2.29	2.52	2.68	2.79	2.88	2.95	3.01	3.15
120	1.76	1.96	2.11	2.22	2.30	2.37	2.43	2.57	2.25	2.48	2.62	2.73	2.82	2.89	2.95	3.08
∞	1.74	1.94	2.08	2.18	2.27	2.33	2.39	2.52	2.22	2.43	2.57	2.68	2.76	2.83	2.88	3.01

TABLE A-17. CONFIDENCE BELTS FOR THE CORRELATION COEFFICIENT (CONFIDENCE COEFFICIENT .95)



SCALE OF r (SAMPLE CORRELATION COEFFICIENT)
THE NUMBERS ON THE CURVES INDICATE SAMPLE SIZE

TABLE A-18. WEIGHTING COEFFICIENTS FOR PROBIT ANALYSIS

Y	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.006	0.008	0.011
2	0.015	0.019	0.025	0.031	0.040	0.050	0.062	0.076	0.092	0.110
3	0.131	0.154	0.180	0.208	0.238	0.269	0.302	0.336	0.370	0.405
4	0.439	0.471	0.503	0.532	0.558	0.581	0.601	0.616	0.627	0.634
5	0.637	0.634	0.627	0.616	0.601	0.581	0.558	0.532	0.503	0.471
6	0.439	0.405	0.370	0.336	0.302	0.269	0.238	0.208	0.180	0.154
7	0.131	0.110	0.092	0.076	0.062	0.050	0.040	0.031	0.025	0.019
8	0.015	0.011	0.008	0.006	0.005	0.003	0.002	0.002	0.001	0.001

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TABLE A-19. MAXIMUM AND MINIMUM WORKING PROBITS AND RANGE

Expected Probit Y	Minimum Working Probit y_0	Range $1/Z$	Maximum Working Probit y_{100}	Expected Probit Y
1.1	0.8579	5034	9.1421	8.9
1.2	0.9522	3425	9.0478	8.8
1.3	1.0462	2354	8.9538	8.7
1.4	1.1400	1634	8.8600	8.6
1.5	1.2334	1146	8.7666	8.5
1.6	1.3266	811.5	8.6734	8.4
1.7	1.4194	580.5	8.5806	8.3
1.8	1.5118	419.4	8.4882	8.2
1.9	1.6038	306.1	8.3962	8.1
2.0	1.6954	225.6	8.3046	8.0
2.1	1.7866	168.00	8.2134	7.9
2.2	1.8772	126.34	8.1228	7.8
2.3	1.9673	95.96	8.0327	7.7
2.4	2.0568	73.62	7.9432	7.6
2.5	2.1457	57.05	7.8543	7.5
2.6	2.2339	44.654	7.7661	7.4
2.7	2.3214	35.302	7.6786	7.3
2.8	2.4081	28.189	7.5919	7.2
2.9	2.4938	22.736	7.5062	7.1
3.0	2.5786	18.522	7.4214	7.0
3.1	2.6624	15.240	7.3376	6.9
3.2	2.7449	12.666	7.2551	6.8
3.3	2.8261	10.633	7.1739	6.7
3.4	2.9060	9.015	7.0940	6.6
3.5	2.9842	7.721	7.0158	6.5
3.6	3.0606	6.6788	6.9394	6.4
3.7	3.1351	5.8354	6.8649	6.3
3.8	3.2074	5.1497	6.7926	6.2
3.9	3.2773	4.5903	6.7227	6.1
4.0	3.3443	4.1327	6.6557	6.0
4.1	3.4083	3.7582	6.5917	5.9
4.2	3.4687	3.4519	6.5313	5.8
4.3	3.5251	3.2025	6.4749	5.7
4.4	3.5770	3.0010	6.4230	5.6
4.5	3.6236	2.8404	6.3764	5.5
4.6	3.6643	2.7154	6.3357	5.4
4.7	3.6982	2.6220	6.3018	5.3
4.8	3.7241	2.5573	6.2759	5.2
4.9	3.7407	2.5192	6.2593	5.1
5.0	3.7467	2.5066	6.2533	5.0

Discrepancies between the source table and some other tables were noted in the entries for y_o corresponding to Y = 1.5 and Y = 2.6. These two values were recalculated and altered from the source table in the last place.

TABLE A-20. FACTORS FOR COMPUTING TWO-SIDED CONFIDENCE LIMITS FOR σ

Degrees of Freedom ν	$\alpha = .05$ B_U	$\alpha = .05$ B_L	$\alpha = .01$ B_U	$\alpha = .01$ B_L	$\alpha = .001$ B_U	$\alpha = .001$ B_L
1	17.79	.3576	86.31	.2969	844.4	.2480
2	4.859	.4581	10.70	.3879	33.29	.3291
3	3.183	.5178	5.449	.4453	11.65	.3824
4	2.567	.5590	3.892	.4865	6.938	.4218
5	2.248	.5899	3.175	.5182	5.085	.4529
6	2.052	.6143	2.764	.5437	4.128	.4784
7	1.918	.6344	2.498	.5650	3.551	.5000
8	1.820	.6513	2.311	.5830	3.167	.5186
9	1.746	.6657	2.173	.5987	2.894	.5348
10	1.686	.6784	2.065	.6125	2.689	.5492
11	1.638	.6896	1.980	.6248	2.530	.5621
12	1.598	.6995	1.909	.6358	2.402	.5738
13	1.564	.7084	1.851	.6458	2.298	.5845
14	1.534	.7166	1.801	.6549	2.210	.5942
15	1.509	.7240	1.758	.6632	2.136	.6032
16	1.486	.7308	1.721	.6710	2.073	.6116
17	1.466	.7372	1.688	.6781	2.017	.6193
18	1.448	.7430	1.658	.6848	1.968	.6266
19	1.432	.7484	1.632	.6909	1.925	.6333
20	1.417	.7535	1.609	.6968	1.886	.6397
21	1.404	.7582	1.587	.7022	1.851	.6457
22	1.391	.7627	1.568	.7074	1.820	.6514
23	1.380	.7669	1.550	.7122	1.791	.6568
24	1.370	.7709	1.533	.7169	1.765	.6619
25	1.360	.7747	1.518	.7212	1.741	.6668
26	1.351	.7783	1.504	.7253	1.719	.6713
27	1.343	.7817	1.491	.7293	1.698	.6758
28	1.335	.7849	1.479	.7331	1.679	.6800
29	1.327	.7880	1.467	.7367	1.661	.6841
30	1.321	.7909	1.457	.7401	1.645	.6880
31	1.314	.7937	1.447	.7434	1.629	.6917
32	1.308	.7964	1.437	.7467	1.615	.6953
33	1.302	.7990	1.428	.7497	1.601	.6987
34	1.296	.8015	1.420	.7526	1.588	.7020
35	1.291	.8039	1.412	.7554	1.576	.7052
36	1.286	.8062	1.404	.7582	1.564	.7083
37	1.281	.8085	1.397	.7608	1.553	.7113
38	1.277	.8106	1.390	.7633	1.543	.7141
39	1.272	.8126	1.383	.7658	1.533	.7169
40	1.268	.8146	1.377	.7681	1.523	.7197
41	1.264	.8166	1.371	.7705	1.515	.7223
42	1.260	.8184	1.365	.7727	1.506	.7248
43	1.257	.8202	1.360	.7748	1.498	.7273
44	1.253	.8220	1.355	.7769	1.490	.7297
45	1.249	.8237	1.349	.7789	1.482	.7320
46	1.246	.8253	1.345	.7809	1.475	.7342
47	1.243	.8269	1.340	.7828	1.468	.7364
48	1.240	.8285	1.335	.7847	1.462	.7386
49	1.237	.8300	1.331	.7864	1.455	.7407
50	1.234	.8314	1.327	.7882	1.449	.7427

Adapted with permission from *Biometrika*, Vol. 47, (1960), from article entitled "Tables for Making Inferences About the Variance of a Normal Distribution" by D. V. Lindley, D. A. East, and F. A. Hamilton.

TABLE A-20 (Continued). FACTORS FOR COMPUTING TWO-SIDED CONFIDENCE LIMITS FOR σ

Degrees of Freedom ν	α = .05		α = .01		α = .001	
	B_U	B_L	B_U	B_L	B_U	B_L
51	1.232	.8329	1.323	.7899	1.443	.7446
52	1.229	.8343	1.319	.7916	1.437	.7466
53	1.226	.8356	1.315	.7932	1.432	.7485
54	1.224	.8370	1.311	.7949	1.426	.7503
55	1.221	.8383	1.308	.7964	1.421	.7521
56	1.219	.8395	1.304	.7979	1.416	.7539
57	1.217	.8408	1.301	.7994	1.411	.7556
58	1.214	.8420	1.298	.8008	1.406	.7573
59	1.212	.8431	1.295	.8022	1.402	.7589
60	1.210	.8443	1.292	.8036	1.397	.7605
61	1.208	.8454	1.289	.8050	1.393	.7621
62	1.206	.8465	1.286	.8063	1.389	.7636
63	1.204	.8475	1.283	.8076	1.385	.7651
64	1.202	.8486	1.280	.8088	1.381	.7666
65	1.200	.8496	1.277	.8101	1.377	.7680
66	1.199	.8506	1.275	.8113	1.374	.7694
67	1.197	.8516	1.272	.8125	1.370	.7708
68	1.195	.8525	1.270	.8137	1.366	.7722
69	1.194	.8535	1.268	.8148	1.363	.7735
70	1.192	.8544	1.265	.8159	1.360	.7749
71	1.190	.8553	1.263	.8170	1.356	.7761
72	1.139	.8562	1.261	.8181	1.353	.7774
73	1.187	.8571	1.259	.8191	1.350	.7787
74	1.186	.8580	1.257	.8202	1.347	.7799
75	1.184	.8588	1.255	.8212	1.344	.7811
76	1.183	.8596	1.253	.8222	1.341	.7822
77	1.182	.8604	1.251	.8232	1.338	.7834
78	1.181	.8612	1.249	.8242	1.336	.7845
79	1.179	.8620	1.247	.8252	1.333	.7856
80	1.178	.8627	1.245	.8261	1.330	.7868
81	1.176	.8635	1.243	.8270	1.328	.7878
82	1.176	.8642	1.241	.8279	1.325	.7889
83	1.174	.8650	1.239	.8288	1.323	.7899
84	1.173	.8657	1.238	.8297	1.320	.7909
85	1.172	.8664	1.236	.8305	1.318	.7920
86	1.171	.8671	1.235	.8314	1.316	.7930
87	1.170	.8678	1.233	.8322	1.313	.7939
88	1.168	.8684	1.231	.8331	1.311	.7949
89	1.167	.8691	1.230	.8338	1.309	.7959
90	1.166	.8697	1.228	.8346	1.307	.7968
91	1.165	.8704	1.227	.8354	1.305	.7977
92	1.164	.8710	1.225	.8362	1.303	.7987
93	1.163	.8716	1.224	.8370	1.301	.7996
94	1.162	.8722	1.222	.8377	1.298	.8004
95	1.161	.8729	1.221	.8385	1.297	.8013
96	1.160	.8734	1.219	.8392	1.295	.8022
97	1.159	.8741	1.218	.8399	1.293	.8031
98	1.158	.8746	1.217	.8406	1.291	.8039
99	1.158	.8752	1.216	.8413	1.289	.8047
100	1.157	.8757	1.214	.8420	1.288	.8055

TABLE A-21. FACTORS FOR COMPUTING ONE-SIDED CONFIDENCE LIMITS FOR σ

Degrees of Freedom ν	$A_{.05}$	$A_{.95}$	$A_{.025}$	$A_{.975}$	$A_{.01}$	$A_{.99}$	$A_{.005}$	$A_{.995}$
1	.5103	15.947	.4461	31.910	.3882	79.786	.3562	159.576
2	.5778	4.415	.5207	6.285	.4660	9.975	.4344	14.124
3	.6196	2.920	.5665	3.729	.5142	5.111	.4834	6.467
4	.6493	2.372	.5992	2.874	.5489	3.669	.5188	4.396
5	.6721	2.089	.6242	2.453	.5757	3.003	.5464	3.485
6	.6903	1.915	.6444	2.202	.5974	2.623	.5688	2.980
7	.7054	1.797	.6612	2.035	.6155	2.377	.5875	2.660
8	.7183	1.711	.6754	1.916	.6310	2.204	.6037	2.439
9	.7293	1.645	.6878	1.826	.6445	2.076	.6177	2.278
10	.7391	1.593	.6987	1.755	.6564	1.977	.6301	2.154
11	.7477	1.551	.7084	1.698	.6670	1.898	.6412	2.056
12	.7554	1.515	.7171	1.651	.6765	1.833	.6512	1.976
13	.7624	1.485	.7250	1.611	.6852	1.779	.6603	1.909
14	.7688	1.460	.7321	1.577	.6931	1.733	.6686	1.854
15	.7747	1.437	.7387	1.548	.7004	1.694	.6762	1.806
20	.7979	1.358	.7650	1.444	.7297	1.556	.7071	1.640
25	.8149	1.308	.7843	1.380	.7511	1.473	.7299	1.542
30	.8279	1.274	.7991	1.337	.7678	1.416	.7477	1.475
40	.8470	1.228	.8210	1.279	.7925	1.343	.7740	1.390
50	.8606	1.199	.8367	1.243	.8103	1.297	.7931	1.337
60	.8710	1.179	.8487	1.217	.8239	1.265	.8078	1.299
70	.8793	1.163	.8583	1.198	.8349	1.241	.8196	1.272
80	.8861	1.151	.8662	1.183	.8439	1.222	.8293	1.250
90	.8919	1.141	.8728	1.171	.8515	1.207	.8376	1.233
100	.8968	1.133	.8785	1.161	.8581	1.195	.8446	1.219

For large degrees of freedom, we may use the approximate formula:

$$A_P = \sqrt{2\nu}/(z_P + \sqrt{2\nu - 1}),$$

where z_P is found in Table A-2.

TABLES

TABLE A-22. CONFIDENCE LIMITS FOR A PROPORTION (TWO-SIDED)

For confidence limits for $n > 30$, see Table A-24.

Upper limits are in boldface. The observed proportion in a random sample is r/n

r	90%		95%		99%	
n = 1						
0	0	**.900**	0	**.950**	0	**.990**
1	.100	**1**	.050	**1**	.010	**1**
n = 2						
0	0	**.684**	0	**.779**	0	**.900**
1	.051	**.949**	.025+	**.975−**	.005+	**.995−**
2	.316	**1**	.224	**1**	.100	**1**
n = 3						
0	0	**.536**	0	**.632**	0	**.785−**
1	.035−	**.804**	.017	**.865−**	.003	**.941**
2	.196	**.965+**	.135+	**.983**	.059	**.997**
3	.464	**1**	.368	**1**	.215+	**1**
n = 4						
0	0	**.500**	0	**.527**	0	**.684**
1	.026	**.680**	.013	**.751**	.003	**.859**
2	.143	**.857**	.098	**.902**	.042	**.958**
3	.320	**.974**	.249	**.987**	.141	**.997**
4	.500	**1**	.473	**1**	.316	**1**
n = 5						
0	0	**.379**	0	**.500**	0	**.602**
1	.021	**.621**	.010	**.657**	.002	**.778**
2	.112	**.753**	.076	**.811**	.033	**.894**
3	.247	**.888**	.189	**.924**	.106	**.967**
4	.379	**.979**	.343	**.990**	.222	**.998**
5	.621	**1**	.500	**1**	.398	**1**
n = 6						
0	0	**.345−**	0	**.402**	0	**.536**
1	.017	**.542**	.009	**.598**	.002	**.706**
2	.093	**.667**	.063	**.729**	.027	**.827**
3	.201	**.799**	.153	**.847**	.085−	**.915+**
4	.333	**.907**	.271	**.937**	.173	**.973**
5	.458	**.983**	.402	**.991**	.294	**.998**
6	.655+	**1**	.598	**1**	.464	**1**
n = 7						
0	0	**.319**	0	**.377**	0	**.500**
1	.015−	**.500**	.007	**.554**	.001	**.643**
2	.079	**.684**	.053	**.659**	.023	**.764**
3	.170	**.721**	.129	**.775−**	.071	**.858**
4	.279	**.830**	.225+	**.871**	.142	**.929**
5	.316	**.921**	.341	**.947**	.236	**.977**
6	.500	**.985+**	.446	**.993**	.357	**.999**
7	.684	**1**	.623	**1**	.500	**1**
n = 8						
0	0	**.255−**	0	**.315+**	0	**.451**
1	.013	**.418**	.006	**.500**	.001	**.590**
2	.069	**.582**	.046	**.685−**	.020	**.707**
3	.147	**.745+**	.111	**.711**	.061	**.802**
4	.240	**.760**	.193	**.807**	.121	**.879**
5	.255−	**.853**	.289	**.889**	.198	**.939**
6	.418	**.931**	.315+	**.954**	.293	**.980**
7	.582	**.987**	.500	**.994**	.410	**.999**
8	.745+	**1**	.685−	**1**	.549	**1**
n = 9						
0	0	**.232**	0	**.289**	0	**.402**
1	.012	**.391**	.006	**.443**	.001	**.598**
2	.061	**.515+**	.041	**.558**	.017	**.656**
3	.129	**.610**	.098	**.711**	.053	**.750**
4	.210	**.768**	.169	**.749**	.105+	**.829**
5	.232	**.790**	.251	**.831**	.171	**.895−**
6	.390	**.871**	.289	**.902**	.250	**.947**
7	.485−	**.939**	.442	**.959**	.344	**.983**
8	.609	**.988**	.557	**.994**	.402	**.999**
9	.768	**1**	.711	**1**	.598	**1**
n = 10						
0	0	**.222**	0	**.267**	0	**.379**
1	.010	**.352**	.005+	**.397**	.001	**.512**
2	.055−	**.500**	.037	**.603**	.016	**.624**
3	.116	**.648**	.087	**.619**	.048	**.703**
4	.188	**.659**	.150	**.733**	.093	**.782**
5	.222	**.778**	.222	**.778**	.150	**.850**
6	.341	**.812**	.267	**.850**	.218	**.907**
7	.352	**.884**	.381	**.913**	.297	**.952**
8	.500	**.945+**	.397	**.963**	.376	**.984**
9	.648	**.990**	.603	**.995−**	.488	**.999**
10	.778	**1**	.733	**1**	.624	**1**
n = 11						
0	0	**.197**	0	**.250**	0	**.359**
1	.010	**.315+**	.005−	**.369**	.001	**.500**
2	.049	**.423**	.033	**.500**	.014	**.593**
3	.105−	**.577**	.079	**.631**	.043	**.660**
4	.169	**.685−**	.135+	**.667**	.084	**.738**
5	.197	**.698**	.200	**.750**	.134	**.806**
6	.302	**.803**	.250	**.800**	.194	**.866**
7	.315+	**.831**	.333	**.865−**	.262	**.916**
8	.423	**.895+**	.369	**.921**	.340	**.957**
9	.577	**.951**	.500	**.967**	.407	**.986**
10	.685−	**.990**	.631	**.995+**	.500	**.999**
11	.803	**1**	.750	**1**	.641	**1**
n = 12						
0	0	**.194**	0	**.236**	0	**.321**
1	.009	**.294**	.004	**.346**	.001	**.445+**
2	.045+	**.398**	.030	**.450**	.013	**.555−**
3	.096	**.500**	.072	**.550**	.039	**.679**
4	.154	**.602**	.123	**.654**	.078	**.698**
5	.184	**.706**	.181	**.706**	.121	**.765+**
6	.271	**.729**	.235	**.765**	.175−	**.825+**
7	.294	**.816**	.294	**.819**	.235−	**.879**
8	.398	**.846**	.346	**.877**	.302	**.924**
9	.500	**.904**	.450	**.928**	.321	**.961**
10	.602	**.955−**	.550	**.970**	.445+	**.987**
11	.706	**.991**	.654	**.996**	.555−	**.999**
12	.806	**1**	.764	**1**	.679	**1**

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TABLE A-22 (Continued). CONFIDENCE LIMITS FOR A PROPORTION (TWO-SIDED)

n = 13

r	90%		95%		99%	
0	0	.176	0	.226+	0	.302
1	.008	.279	.004	.327	.001	.429
2	.042	.379	.028	.434	.012	.523
3	.088	.476	.066	.520	.036	.594
4	.142	.546−	.116	.587	.069	.698
5	.173	.621	.166	.672	.111	.727
6	.249	.724	.224	.746	.159	.787
7	.276	.754	.260	.776	.216	.841
8	.379	.827	.327	.834	.273	.889
9	.455+	.858	.416	.887	.302	.931
10	.580	.912	.480	.934	.406	.964
11	.621	.958	.566	.972	.477	.988
12	.724	.992	.673	.996	.571	.999
13	.827	1	.775−	1	.698	1

n = 14

r	90%		95%		99%	
0	0	.163	0	.207	0	.286
1	.007	.291	.004	.312	.001	.392
2	.039	.299+	.026	.389	.011	.500
3	.061	.422	.061	.500	.033	.608
4	.131	.579	.104	.611	.064	.636
5	.163	.594	.153	.629	.102	.714
6	.224	.640+	.206	.688	.146	.751
7	.261	.729	.207	.793	.195−	.805+
8	.355−	.776	.312	.794	.249	.854
9	.406	.837	.371	.847	.286	.898
10	.422	.869	.389	.896	.364	.926
11	.578	.919	.500	.929	.392	.997
12	.635−	.961	.611	.974	.500	.989
13	.739	.993	.688	.996	.608	.999
14	.837	1	.793	1	.714	1

n = 15

r	90%		95%		99%	
0	0	.154	0	.191	0	.270
1	.007	.247	.003	.362	.001	.370
2	.084	.329	.024	.369	.010	.461
3	.076	.400	.057	.449	.031	.589
4	.122	.500	.097	.552	.059	.627
5	.154	.600	.142	.631	.094	.672
6	.205+	.674	.191	.668	.135−	.727
7	.247	.670−	.192	.706	.179	.771
8	.325+	.753	.294	.808	.229	.821
9	.326	.799−	.332	.809	.273	.865+
10	.400	.846	.369	.858	.328	.906
11	.500	.876	.448	.903	.373	.941
12	.600	.924	.552	.943	.461	.969
13	.674	.964	.631	.976	.529	.990
14	.753	.993	.696	.997	.627	.999
15	.846	1	.809	1	.727	1

n = 16

r	90%		95%		99%	
0	0	.147	0	.179	0	.264
1	.007	.239+	.003	.272	.001	.357
2	.034	.365+	.023	.352	.010	.451
3	.071	.381	.053	.429	.029	.525−
4	.114	.450	.090	.500	.055+	.579
5	.147	.550	.132	.571	.088	.643
6	.189	.619	.178	.648	.125+	.705−
7	.235+	.696−	.179	.727	.166	.720
8	.299	.701	.272	.728	.212	.788
9	.305+	.706−	.273	.821	.261	.834
10	.381	.811	.352	.822	.295+	.875−
11	.450	.858	.429	.868	.357	.912
12	.550	.886	.500	.916	.421	.940−
13	.619	.929	.571	.947	.475+	.971
14	.695−	.966	.648	.977	.549	.990
15	.765−	.993	.727	.997	.643	.999
16	.853	1	.821	1	.736	1

n = 17

r	90%		95%		99%	
0	0	.140	0	.197	0	.243
1	.006	.225+	.003	.254	.001	.349
2	.032	.290	.021	.337	.009	.419
3	.067	.364	.050	.417	.027	.500
4	.107	.432	.085−	.499	.052	.587
5	.140	.500	.124	.544	.082	.620
6	.175+	.599	.166	.594	.117	.662
7	.225+	.639	.167	.663	.155+	.757
8	.277	.716	.253	.746	.197	.798
9	.290	.723	.254	.747	.242	.803
10	.364	.775−	.337	.833	.243	.845
11	.432	.626−	.406	.834	.338	.883
12	.500	.666	.456	.876	.380	.918
13	.568	.896	.511	.915+	.416	.948
14	.636	.933	.583	.950	.500	.979
15	.710	.968	.663	.979	.587	.991
16	.775−	.994	.746	.997	.654	.999
17	.860	1	.833	1	.757	1

n = 18

r	90%		95%		99%	
0	0	.165−	0	.167	0	.229
1	.006	.219	.003	.242	.001	.318
2	.030	.277	.020	.326−	.008	.397
3	.063	.349	.047	.361	.025+	.469
4	.101	.419	.080	.444	.049	.534
5	.165−	.462	.116	.550	.077	.569
6	.163	.539	.156	.619	.110	.652
7	.218	.584	.157	.629+	.145+	.659
8	.257	.651	.236	.675+	.184	.772
9	.277	.723	.242	.756	.226	.774
10	.349	.743	.325−	.794	.228	.816
11	.416	.784	.375−	.849	.314	.855−
12	.464	.837	.381	.844	.318	.890
13	.516	.865+	.444	.884	.397	.923
14	.581	.899	.556	.920	.466	.951
15	.651	.937	.619	.953	.534	.975−
16	.723	.970	.675+	.980	.608	.992
17	.784	.994	.758	.997	.682	.999
18	.845+	1	.843	1	.772	1

n = 19

r	90%		95%		99%	
0	0	.136	0	.150	0	.218
1	.006	.209	.003	.232	.001	.306+
2	.028	.265+	.019	.616	.008	.382
3	.058	.337	.044	.365−	.024	.459+
4	.095+	.367	.075+	.426	.046	.519+
5	.130	.440	.110	.500	.073	.564
6	.151	.500	.147	.574	.103	.617
7	.209	.616	.150	.626+	.137	.695−
8	.238	.614	.222	.655+	.173	.767
9	.265+	.663	.232	.688	.212	.762
10	.337	.709−	.612	.769	.216	.798
11	.386	.762	.345−	.778	.238	.827
12	.387	.791	.365−	.850	.305+	.863
13	.440	.649	.426	.853	.383	.897
14	.560	.676	.500	.890	.436	.927
15	.618	.909−	.574	.929−	.485−	.954
16	.663	.941	.635+	.956	.545−	.979
17	.735−	.972	.654	.981	.617	.992
18	.791	.994	.768	.997	.696−	.999
19	.870	1	.850	1	.782	1

n = 20

r	90%		95%		99%	
0	0	.129	0	.143	0	.209
1	.005+	.203	.003	.222	.001	.293
2	.027	.258−	.018	.294	.008	.379−
3	.056	.326	.042	.351	.023	.424
4	.090	.367	.071	.411	.044	.500
5	.126	.422	.104	.497	.069	.576
6	.141	.500	.140	.536	.098	.601
7	.201	.578	.143	.589	.129	.637
8	.221	.633	.209	.649	.163	.707
9	.255−	.642	.222	.706	.200	.729
10	.325	.679+	.293	.707	.209	.791
11	.358	.745+	.294	.779	.274	.800
12	.367	.779	.351	.791	.293	.837
13	.422	.799	.411	.657	.363	.871
14	.500	.659	.467	.860	.399	.902
15	.578	.674	.533	.896	.424	.931
16	.633	.919	.589	.929	.500	.956
17	.672	.944	.649	.958	.576	.977
18	.745+	.976	.706	.992	.626+	.992
19	.797	.996−	.778	.997	.707	.999
20	.874	1	.857	1	.791	1

TABLE A-22 (Continued). CONFIDENCE LIMITS FOR A PROPORTION (TWO-SIDED)

n = 21

r	90%		95%		99%	
0	0	.123	0	.137	0	.201
1	.005+	.192	.002	.213	.000	.283
2	.026	.245−	.017	.277	.007	.347
3	.054	.307	.040	.338	.022	.409
4	.086	.353	.068	.398	.041	.466
5	.121	.407	.099	.455+	.065+	.534
6	.130	.458	.132	.506	.092	.591
7	.191	.542	.137	.551	.122	.653
8	.192	.593	.197	.602	.155−	.661
9	.245−	.647	.213	.662	.189	.717
10	.306	.693	.276	.723	.201	.743
11	.307	.694	.277	.724	.257	.799
12	.353	.755+	.338	.787	.283	.811
13	.407	.808	.398	.803	.339	.845+
14	.458	.809	.449	.863	.347	.878
15	.542	.870	.494	.868	.409	.908
16	.593	.879	.545−	.901	.466	.935−
17	.647	.914	.602	.932	.534	.959
18	.693	.946	.662	.960	.591	.978
19	.755+	.974	.723	.983	.653	.993
20	.808	.995−	.787	.998	.717	1.000
21	.877	1	.863	1	.799	1

n = 22

r	90%		95%		99%	
0	0	.116	0	.132	0	.194
1	.005−	.182	.002	.205+	.000	.273
2	.024	.236	.016	.264	.007	.334
3	.051	.289	.038	.326	.021	.396
4	.082	.340	.065−	.389	.039	.454
5	.115−	.393	.094	.424	.062	.505−
6	.118	.444	.126	.500	.088	.550
7	.181	.500	.132	.576	.116	.604
8	.182	.556	.187	.590	.147	.666
9	.236	.607	.205+	.617	.179	.682
10	.289	.660	.260	.674	.194	.727
11	.290	.710	.264	.736	.242	.758
12	.340	.711	.326	.740	.273	.806
13	.393	.764	.383	.795−	.318	.821
14	.444	.818	.410	.810	.334	.853
15	.500	.819	.424	.868	.396	.884
16	.556	.882	.500	.874	.450	.912
17	.607	.885+	.576	.906	.495+	.938
18	.660	.918	.611	.935+	.546	.961
19	.711	.949	.674	.962	.604	.979
20	.764	.976	.736	.984	.666	.993
21	.818	.995+	.795−	.998	.727	1.000
22	.884	1	.868	1	.806	1

n = 23

r	90%		95%		99%	
0	0	.111	0	.127	0	.182
1	.005−	.174	.002	.198	.000	.265+
2	.023	.228	.016	.255−	.007	.323
3	.049	.274	.037	.317	.020	.386
4	.078	.328	.062	.361	.038	.429
5	.110	.381	.090	.409	.059	.500
6	.111	.431	.120	.457	.084	.571
7	.173	.479	.127	.543	.111	.580
8	.174	.522	.178	.591	.140	.616
9	.228	.569	.198	.639	.171	.677
10	.273	.619	.247	.640	.187	.702
11	.274	.672	.255−	.683	.229	.735−
12	.328	.726	.317	.745+	.265+	.771
13	.381	.727	.360	.753	.298	.813
14	.431	.772	.361	.802	.323	.829
15	.478	.826	.409	.822	.384	.860
16	.521	.827	.457	.873	.420	.889
17	.569	.889	.543	.880	.429	.916
18	.619	.890	.591	.910	.500	.941
19	.672	.922	.639	.938	.571	.962
20	.726	.951	.683	.963	.614	.980
21	.772	.977	.745+	.984	.677	.993
22	.826	.995+	.802	.998	.735−	1.000
23	.889	1	.873	1	.818	1

n = 24

r	90%		95%		99%	
0	0	.105+	0	.122	0	.181
1	.004	.165+	.002	.191	.000	.259
2	.022	.221	.015+	.246	.006	.313
3	.047	.264	.035−	.308	.019	.364
4	.075−	.317	.059	.347	.036	.416
5	.105−	.370	.086	.396	.057	.464
6	.105+	.423	.115−	.443	.080	.536
7	.165−	.448	.122	.500	.106	.584
8	.165+	.552	.169	.557	.133	.636
9	.221	.553	.191	.604	.163	.638
10	.259	.587	.234	.653	.181	.687
11	.264	.630	.246	.661	.216	.720
12	.317	.683	.308	.692	.257	.743
13	.370	.736	.339	.754	.280	.784
14	.413	.741	.347	.766	.313	.819
15	.447	.779	.396	.809	.362	.837
16	.448	.835−	.443	.831	.364	.867
17	.552	.835+	.500	.878	.416	.894
18	.577	.895−	.557	.885+	.464	.920
19	.630	.895+	.604	.914	.536	.943
20	.683	.925+	.653	.941	.584	.964
21	.736	.953	.692	.965+	.636	.981
22	.779	.978	.754	.985−	.687	.994
23	.835−	.996	.809	.998	.741	1.000
24	.895−	1	.878	1	.819	1

n = 25

r	90%		95%		99%	
0	0	.102	0	.118	0	.175+
1	.004	.159	.002	.185+	.000	.246
2	.021	.214	.014	.238	.006	.305−
3	.045−	.255−	.034	.303	.018	.352
4	.072	.307	.057	.336	.034	.403
5	.101	.362	.082	.384	.054	.451
6	.102	.390	.110	.431	.077	.500
7	.158	.432	.118	.475−	.101	.549
8	.159	.500	.161	.525+	.127	.597
9	.214	.568	.185+	.569	.155+	.648
10	.246	.610	.222	.616	.175+	.658
11	.255−	.611	.238	.664	.205+	.695+
12	.307	.640	.296	.683	.245+	.754
13	.360	.693	.317	.704	.246	.755−
14	.389	.745+	.336	.762	.305−	.795−
15	.390	.754	.384	.778	.342	.825−
16	.432	.786	.431	.815−	.352	.845−
17	.500	.841	.475−	.839	.403	.873
18	.568	.842	.525+	.882	.451	.899
19	.610	.898	.569	.890	.500	.923
20	.638	.899	.616	.918	.549	.946
21	.693	.928	.664	.943	.597	.966
22	.745+	.955+	.697	.966	.648	.982
23	.786	.979	.762	.986	.695+	.994
24	.841	.996	.815−	.998	.754	1.000
25	.898	1	.882	1	.825−	1

n = 26

r	90%		95%		99%	
0	0	.098	0	.114	0	.170
1	.004	.152	.002	.180	.000	.235−
2	.021	.209	.014	.230	.006	.298
3	.043	.247	.032	.283	.017	.342
4	.069	.299	.054	.325+	.033	.393
5	.097	.343	.079	.374	.052	.442
6	.098	.377	.106	.421	.073	.487
7	.151	.419	.114	.465−	.097	.526
8	.152	.460	.164	.506	.122	.562
9	.209	.540	.180	.542	.149	.607
10	.233	.581	.212	.579	.170	.658
11	.247	.623	.230	.626	.195−	.678
12	.299	.657	.282	.675−	.234	.702
13	.342	.658	.283	.717	.235−	.765+
14	.343	.701	.325+	.718	.298	.766
15	.377	.753	.374	.770	.322	.805+
16	.419	.767	.421	.788	.342	.830
17	.460	.791	.458	.820	.393	.851
18	.540	.848	.494	.836	.438	.878
19	.581	.849	.535−	.886	.474	.903
20	.623	.902	.579	.894	.513	.927
21	.657	.903	.626	.921	.558	.948
22	.701	.931	.675−	.946	.607	.967
23	.753	.957	.717	.968	.658	.983
24	.791	.979	.770	.986	.702	.994
25	.848	.996	.820	.998	.765+	1.000
26	.902	1	.886	1	.830	1

TABLE A-22 (Continued). CONFIDENCE LIMITS FOR A PROPORTION (TWO-SIDED)

n = 27

r	90%		95%		99%	
0	0	.092	0	.110	0	.166
1	.004	.146	.002	.175 −	.000	.225 −
2	.020	.204	.018	.222	.006	.297
3	.042	.239	.031	.270	.017	.332
4	.068	.291	.052	.316	.032	.354
5	.098	.327	.076	.364	.050	.419
6	.094	.365 +	.101	.416 −	.070	.461
7	.145 +	.407	.110	.437	.093	.539
8	.146	.447	.148	.500	.117	.581
9	.204	.500	.175 −	.563	.143	.587
10	.221	.553	.202	.570	.166	.517
11	.239	.593	.223	.598	.185 −	.668
12	.291	.635 −	.269	.636	.224	.702
13	.325	.673	.270	.684	.225 −	.716
14	.327	.674	.316	.730	.264	.775 +
15	.866 +	.709	.364	.731	.298	.776
16	.407	.761	.402	.777	.332	.815 +
17	.447	.779	.430	.796	.383	.834
18	.500	.796	.437	.825 +	.413	.857
19	.553	.654	.500	.852	.419	.883
20	.593	.856 −	.563	.890	.461	.907
21	.635 −	.905	.585 +	.899	.539	.930
22	.573	.907	.635	.924	.581	.950
23	.709	.924	.684	.945	.616	.966
24	.761	.953	.730	.969	.668	.963
25	.795	.980	.777	.957	.703	.994
26	.854	.996	.825 +	.995	.775 +	1.000
27	.907	1	.890	1	.834	1

n = 28

r	90%		95%		99%	
0	0	.090	0	.166	0	.152
1	.004	.140	.002	.170	.000	.215
2	.019	.201	.013	.217	.005 +	.272
3	.040	.232	.030	.259	.016	.323
4	.064	.264	.050	.307	.031	.365 −
5	.089	.312	.073	.357	.048	.408
6	.090	.356 −	.098	.364	.068	.449
7	.139	.396	.106	.424	.089	.560
8	.140	.435 +	.142	.463	.112	.551
9	.197	.473	.170	.537	.137	.592
10	.206	.527	.192	.576	.162	.635 +
11	.232	.565 −	.217	.616	.175 +	.626
12	.284	.604	.258	.619	.214	.677
13	.310	.645 +	.259	.645 +	.218	.727
14	.312	.688	.307	.693	.272	.728
15	.355 −	.690	.355 −	.741	.273	.782
16	.396	.716	.351	.742	.323	.786
17	.435 ●	.768	.384	.783	.364	.825 −
18	.473	.792	.424	.808	.365 −	.835
19	.527	.863	.463	.820	.408	.862
20	.565 −	.860	.537	.556	.449	.868
21	.604	.861	.576	.894	.500	.911
22	.645 +	.910	.615	.902	.551	.922
23	.688	.911	.643	.927	.592	.952
24	.716	.926	.593	.950	.635 +	.969
25	.768	.960	.741	.970	.677	.964
26	.799	.951	.783	.987	.727	.995 −
27	.860	.996	.850	.998	.782	1.000
28	.910	1	.894	1	.838	1

n = 29

r	90%		95%		99%	
0	0	.067	0	.103	0	.160
1	.004	.135 −	.002	.165	.000	.211
2	.018	.190	.012	.211	.005 +	.263
3	.039	.225 −	.029	.251	.015 +	.316
4	.062	.279	.049	.299	.030	.354
5	.086	.303	.070	.340	.046	.397
6	.087	.345 −	.094	.374	.065 +	.438
7	.184	.385 +	.103	.412	.056	.477
8	.135 −	.425 −	.136	.451	.108	.523
9	.189	.453	.166	.500	.132	.562
10	.190	.500	.184	.549	.157	.602
11	.225 −	.537	.211	.567	.165 +	.646
12	.276	.575 +	.247	.626	.206	.654
13	.294	.615 −	.251	.660	.211	.684
14	.303	.655 +	.299	.661	.260	.737
15	.345 −	.697	.339	.761	.263	.740
16	.355 +	.706	.340	.749	.316	.789
17	.425 −	.724	.374	.752	.345	.794
18	.463	.775 +	.418	.789	.354	.835 −
19	.500	.610	.451	.616	.397	.543
20	.537	.811	.500	.524	.438	.566
21	.575 +	.865 +	.549	.564	.477	.892
22	.615 −	.866	.587	.697	.523	.914
23	.655 +	.912	.625	.906	.562	.935 −
24	.697	.914	.660	.920	.608	.954
25	.721	.938	.701	.951	.646	.970
26	.775 +	.961	.749	.971	.684	.985 −
27	.810	.982	.789	.988	.737	.995 −
28	.855 +	.996	.834	.998	.789	1.000
29	.913	1	.697	1	.640	1

n = 30

r	90%		95%		99%	
0	0	.054	0	.106	0	.152
1	.004	.130	.002	.152	.000	.206
2	.018	.183	.012	.205 +	.005 +	.256
3	.037	.219	.028	.244	.015 −	.310
4	.059	.266	.047	.292	.028	.345 −
5	.083	.295 −	.068	.325 −	.045 −	.356
6	.084	.326	.091	.364	.063	.430
7	.129	.376	.100	.402	.083	.469
8	.130	.416	.131	.440	.104	.505 +
9	.182	.455 +	.163	.476	.127	.538
10	.183	.492	.175 +	.524	.151	.570
11	.219	.524	.205 +	.560	.152	.612
12	.265 −	.554	.236	.597	.198	.655 +
13	.266	.554	.244	.636	.206	.671
14	.295 −	.624	.292	.675 +	.249	.692
15	.336	.564	.324	.676	.256	.744
16	.375	.705 +	.325 −	.708	.308	.751
17	.416	.724	.364	.756	.329	.794
18	.446	.735 +	.403	.784	.345 −	.602
19	.476	.781	.440	.795 −	.388	.548
20	.508	.517	.476	.625 −	.430	.549
21	.545 −	.515	.524	.837	.462	.872
22	.584	.570	.560	.869	.495 −	.696
23	.624	.671	.597	.906	.581	.917
24	.664	.915	.636	.909	.570	.927
25	.705 +	.917	.675 +	.932	.612	.965 +
26	.734	.941	.708	.953	.655 +	.972
27	.751	.963	.756	.972	.690	.985 +
28	.817	.952	.795 −	.966	.744	.995 −
29	.870	.996	.837	.985	.794	1.000
30	.916	1	.900	1	.848	1

TABLES

TABLE A-23. CONFIDENCE LIMITS FOR A PROPORTION (ONE-SIDED)

For confidence limits for $n > 30$, see Table A-24.

If the observed proportion is r/n, enter the table with n and r for an upper one-sided limit. For a lower one-sided limit, enter the table with n and $n - r$ and subtract the table entry from 1.

r	90%	95%	99%	r	90%	95%	99%	r	90%	95%	99%
$n = 2$				$n = 3$				$n = 4$			
0	.684	.776	.900	0	.536	.632	.785−	0	.438	.527	.684
1	.949	.975−	.995−	1	.804	.865−	.941	1	.680	.751	.859
				2	.965+	.983	.997	2	.857	.902	.958
								3	.974	.987	.997
$n = 5$				$n = 6$				$n = 7$			
0	.369	.451	.602	0	.319	.393	.536	0	.280	.348	.482
1	.584	.657	.778	1	.510	.582	.706	1	.453	.521	.643
2	.753	.811	.894	2	.667	.729	.827	2	.596	.659	.764
3	.888	.924	.967	3	.799	.847	.915+	3	.721	.775−	.858
4	.979	.990	.998	4	.907	.937	.973	4	.830	.871	.929
				5	.983	.991	.998	5	.921	.947	.977
								6	.985+	.993	.999
$n = 8$				$n = 9$				$n = 10$			
0	.250	.312	.438	0	.226	.283	.401	0	.206	.259	.369
1	.406	.471	.590	1	.368	.429	.544	1	.337	.394	.504
2	.538	.600	.707	2	.490	.550	.656	2	.450	.507	.612
3	.655+	.711	.802	3	.599	.655+	.750	3	.552	.607	.703
4	.760	.807	.879	4	.699	.749	.829	4	.646	.696	.782
5	.853	.889	.939	5	.790	.831	.895−	5	.733	.778	.850
6	.931	.954	.980	6	.871	.902	.947	6	.812	.850	.907
7	.987	.994	.999	7	.939	.959	.983	7	.884	.913	.952
				8	.988	.994	.999	8	.945+	.963	.984
								9	.990	.995−	.999
$n = 11$				$n = 12$				$n = 13$			
0	.189	.238	.342	0	.175−	.221	.319	0	.162	.206	.298
1	.310	.364	.470	1	.287	.339	.440	1	.268	.316	.413
2	.415+	.470	.572	2	.386	.438	.537	2	.360	.410	.506
3	.511	.564	.660	3	.475+	.527	.622	3	.444	.495−	.588
4	.599	.650	.738	4	.559	.609	.698	4	.523	.573	.661
5	.682	.729	.806	5	.638	.685−	.765+	5	.598	.645+	.727
6	.759	.800	.866	6	.712	.755−	.825+	6	.669	.713	.787
7	.831	.865−	.916	7	.781	.819	.879	7	.736	.776	.841
8	.895+	.921	.957	8	.846	.877	.924	8	.799	.834	.889
9	.951	.967	.986	9	.904	.928	.961	9	.858	.887	.931
10	.990	.995+	.999	10	.955−	.970	.987	10	.912	.934	.964
				11	.991	.996	.999	11	.958	.972	.988
								12	.992	.996	.999
$n = 14$				$n = 15$				$n = 16$			
0	.152	.198	.280	0	.142	.181	.264	0	.134	.171	.250
1	.251	.297	.389	1	.236	.279	.368	1	.222	.264	.349
2	.337	.385+	.478	2	.317	.363	.453	2	.300	.344	.430
3	.417	.466	.557	3	.393	.440	.529	3	.371	.417	.503
4	.492	.540	.627	4	.464	.511	.597	4	.439	.484	.569
5	.563	.610	.692	5	.532	.577	.660	5	.504	.548	.630

TABLE A-23 (Continued). CONFIDENCE LIMITS FOR A PROPORTION (ONE-SIDED)

n = 14 (Continued)

r	90%	95%	99%
6	.631	.675−	.751
7	.695+	.736	.805+
8	.757	.794	.854
9	.815−	.847	.898
10	.869	.896	.936
11	.919	.939	.967
12	.961	.974	.989
13	.993	.996	.999

n = 15 (Continued)

r	90%	95%	99%
6	.596	.640	.718
7	.658	.700	.771
8	.718	.756	.821
9	.774	.809	.865+
10	.828	.858	.906
11	.878	.903	.941
12	.924	.943	.969
13	.964	.976	.990
14	.993	.997	.999

n = 16 (Continued)

r	90%	95%	99%
6	.565+	.609	.687
7	.625−	.667	.739
8	.682	.721	.788
9	.737	.773	.834
10	.790	.822	.875−
11	.839	.868	.912
12	.886	.910	.946−
13	.929	.947	.971
14	.966	.977	.990
15	.993	.997	.999

n = 17

r	90%	95%	99%
0	.127	.162	.237
1	.210	.250	.332
2	.284	.326	.410
3	.352	.396	.480
4	.416	.461	.543
5	.478	.522	.603
6	.537	.580	.658
7	.594	.636	.709
8	.650	.689	.758
9	.703	.740	.803
10	.754	.788	.845−
11	.803	.834	.883
12	.849	.876	.918
13	.893	.915+	.948
14	.933	.950	.973
15	.968	.979	.991
16	.994	.997	.999

n = 18

r	90%	95%	99%
0	.120	.153	.226
1	.199	.238	.316
2	.269	.310	.391
3	.334	.377	.458
4	.396	.439	.520
5	.455+	.498	.577
6	.512	.554	.631
7	.567	.608	.681
8	.620	.659	.729
9	.671	.709	.774
10	.721	.756	.816
11	.769	.801	.855−
12	.815−	.844	.890
13	.858	.884	.923
14	.899	.920	.951
15	.937	.953	.975−
16	.970	.980	.992
17	.994	.997	.999

n = 19

r	90%	95%	99%
0	.114	.146	.215+
1	.190	.226	.302
2	.257	.296	.374
3	.319	.359	.439
4	.378	.419	.498
5	.434	.476	.554
6	.489	.530	.606
7	.541	.582	.655+
8	.592	.632	.702
9	.642	.680	.746
10	.690	.726	.788
11	.737	.770	.827
12	.782	.812	.863
13	.825−	.853	.897
14	.866	.890	.927
15	.905−	.925−	.954
16	.941	.956	.976
17	.972	.981	.992
18	.994	.997	.999

n = 20

r	90%	95%	99%
0	.109	.139	.206
1	.181	.216	.289
2	.245−	.283	.358
3	.304	.344	.421
4	.361	.401	.478
5	.415−	.456	.532
6	.467	.508	.583
7	.518	.558	.631
8	.567	.606	.677
9	.615+	.653	.720
10	.662	.698	.761
11	.707	.741	.800
12	.751	.783	.837
13	.793	.823	.871
14	.834	.860	.902
15	.873	.896	.931
16	.910	.929	.956
17	.944	.958	.977
18	.973	.982	.992
19	.995−	.997	.999

n = 21

r	90%	95%	99%
0	.104	.133	.197
1	.173	.207	.277
2	.234	.271	.344
3	.291	.329	.404
4	.345+	.384	.460
5	.397	.437	.512
6	.448	.487	.561
7	.497	.536	.608
8	.544	.583	.653
9	.590	.628	.695+
10	.636	.672	.736
11	.679	.714	.774
12	.722	.755+	.811
13	.764	.794	.845+
14	.804	.832	.878
15	.842	.868	.908
16	.879	.901	.935−
17	.914	.932	.959
18	.946	.960	.978
19	.974	.983	.993
20	.995−	.988	1.000

n = 22

r	90%	95%	99%
0	.099	.127	.189
1	.166	.198	.266
2	.224	.259	.330
3	.279	.316	.389
4	.331	.369	.443
5	.381	.420	.493
6	.430	.468	.541
7	.477	.515+	.587
8	.523	.561	.630
9	.568	.605−	.672
10	.611	.647	.712
11	.654	.689	.750
12	.695+	.729	.786
13	.736	.767	.821
14	.775+	.804	.853
15	.813	.840	.884
16	.850	.874	.912
17	.885+	.906	.938
18	.918	.935+	.961
19	.949	.962	.979
20	.976	.984	.993
21	.995+	.998	1.000

TABLES

TABLE A-23 (Continued). CONFIDENCE LIMITS FOR A PROPORTION (ONE-SIDED)

n = 23

r	90%	95%	99%
0	.095+	.122	.181
1	.159	.190	.256
2	.215+	.249	.318
3	.268	.304	.374
4	.318	.355−	.427
5	.366	.404	.476
6	.413	.451	.522
7	.459	.496	.567
8	.503	.540	.609
9	.546	.583	.650
10	.589	.625−	.689
11	.630	.665−	.727
12	.670	.704	.763
13	.710	.742	.797
14	.748	.778	.829
15	.786	.814	.860
16	.822	.848	.889
17	.857	.880	.916
18	.890	.910	.941
19	.922	.938	.962
20	.951	.963	.980
21	.977	.984	.993
22	.995+	.998	1.000

n = 24

r	90%	95%	99%
0	.091	.117	.175−
1	.153	.183	.246
2	.207	.240	.307
3	.258	.292	.361
4	.306	.342	.412
5	.352	.389	.460
6	.398	.435−	.505−
7	.442	.479	.548
8	.484	.521	.590
9	.526	.563	.630
10	.567	.603	.668
11	.608	.642	.705−
12	.647	.681	.740
13	.685+	.718	.774
14	.723	.754	.806
15	.759	.788	.837
16	.795+	.822	.867
17	.830	.854	.894
18	.863	.885+	.920
19	.895+	.914	.943
20	.925+	.941	.964
21	.953	.965+	.981
22	.978	.985−	.994
23	.996	.998	1.000

n = 25

r	90%	95%	99%
0	.088	.113	.168
1	.147	.176	.237
2	.199	.231	.296
3	.248	.282	.349
4	.295−	.330	.398
5	.340	.375+	.444
6	.383	.420	.488
7	.426	.462	.531
8	.467	.504	.571
9	.508	.544	.610
10	.548	.583	.648
11	.587	.621	.684
12	.625−	.659	.719
13	.662	.695−	.752
14	.699	.730	.784
15	.735−	.764	.815+
16	.770	.798	.845+
17	.804	.830	.873
18	.837	.861	.899
19	.869	.890	.923
20	.899	.918	.946
21	.928	.943	.966
22	.955+	.966	.982
23	.979	.986	.994
24	.996	.998	1.000

n = 26

r	90%	95%	99%
0	.085−	.109	.162
1	.142	.170	.229
2	.192	.223	.286
3	.239	.272	.337
4	.284	.318	.385−
5	.328	.363	.430
6	.370	.405+	.473
7	.411	.447	.514
8	.451	.487	.554
9	.491	.526	.592
10	.529	.564	.628
11	.567	.602	.664
12	.604	.638	.698
13	.641	.673	.731
14	.676	.708	.763
15	.711	.742	.794
16	.746	.774	.823
17	.779	.806	.851
18	.812	.837	.878
19	.843	.866	.903
20	.874	.894	.927
21	.903	.921	.948
22	.931	.946	.967
23	.957	.968	.983
24	.979	.986	.994
25	.996	.998	1.000

n = 27

r	90%	95%	99%
0	.082	.105+	.157
1	.137	.164	.222
2	.185+	.215+	.277
3	.231	.263	.326
4	.275−	.308	.373
5	.317	.351	.417
6	.358	.392	.458
7	.397	.432	.498
8	.436	.471	.537
9	.475−	.509	.574
10	.512	.547	.610
11	.549	.583	.645+
12	.585−	.618	.679
13	.620	.653	.711
14	.655+	.687	.743
15	.689	.720	.773
16	.723	.752	.802
17	.756	.783	.831
18	.788	.814	.857
19	.819	.843	.883
20	.849	.871	.907
21	.879	.899	.930
22	.907	.924	.950
23	.934	.948	.968
24	.958	.969	.983
25	.980	.987	.994
26	.996	.998	1.000

n = 28

r	90%	95%	99%
0	.079	.101	.152
1	.132	.159	.215−
2	.179	.208	.268
3	.223	.254	.316
4	.265+	.298	.361
5	.306	.339	.404
6	.346	.380	.445−
7	.385−	.419	.484
8	.422	.457	.521
9	.459	.494	.558
10	.496	.530	.593
11	.532	.565+	.627
12	.567	.600	.660
13	.601	.634	.692
14	.635+	.667	.723
15	.669	.699	.753
16	.701	.731	.782
17	.733	.762	.810
18	.765−	.792	.837
19	.796	.821	.863
20	.826	.849	.888
21	.855+	.876	.911
22	.883	.902	.932
23	.911	.927	.952
24	.936	.950	.969
25	.960	.970	.984
26	.981	.987	.995−
27	.996	.998	1.000

TABLE A-23 (Continued). CONFIDENCE LIMITS FOR A PROPORTION (ONE-SIDED)

r	90%	95%	99%	r	90%	95%	99%
n = 29				n = 30			
0	.076	.098	.147	0	.074	.095+	.142
1	.128	.153	.208	1	.124	.149	.202
2	.173	.202	.260	2	.168	.195+	.252
3	.216	.246	.307	3	.209	.239	.298
4	.257	.288	.350	4	.249	.280	.340
5	.297	.329	.392	5	.287	.319	.381
6	.335−	.368	.432	6	.325−	.357	.420
7	.372	.406	.470	7	.361	.394	.457
8	.409	.443	.507	8	.397	.430	.493
9	.445+	.479	.542	9	.432	.465+	.527
10	.481	.514	.577	10	.466	.499	.561
11	.515+	.549	.610	11	.500	.533	.594
12	.550	.583	.643	12	.533	.566	.626
13	.583	.616	.674	13	.566	.598	.657
14	.616	.648	.705−	14	.599	.630	.687
15	.649	.680	.734	15	.630	.661	.716
16	.681	.711	.763	16	.662	.692	.744
17	.712	.741	.791	17	.692	.721	.772
18	.743	.771	.818	18	.723	.750	.799
19	.774	.800	.843	19	.752	.779	.824
20	.803	.828	.868	20	.782	.807	.849
21	.832	.855−	.892	21	.810	.834	.873
22	.860	.881	.914	22	.838	.860	.896
23	.888	.906	.935−	23	.865+	.885+	.917
24	.914	.930	.954	24	.891	.909	.937
25	.938	.951	.970	25	.917	.932	.955+
26	.961	.971	.985−	26	.941	.953	.972
27	.982	.988	.995−	27	.963	.972	.985+
28	.996	.998	1.000	28	.982	.988	.995−
				29	.996	.998	1.000

TABLE A-24. CONFIDENCE BELTS FOR PROPORTIONS FOR $n > 30$
(CONFIDENCE COEFFICIENT .90)

For tables of confidence limits for $n \leq 30$, see Tables A-22 and A-23

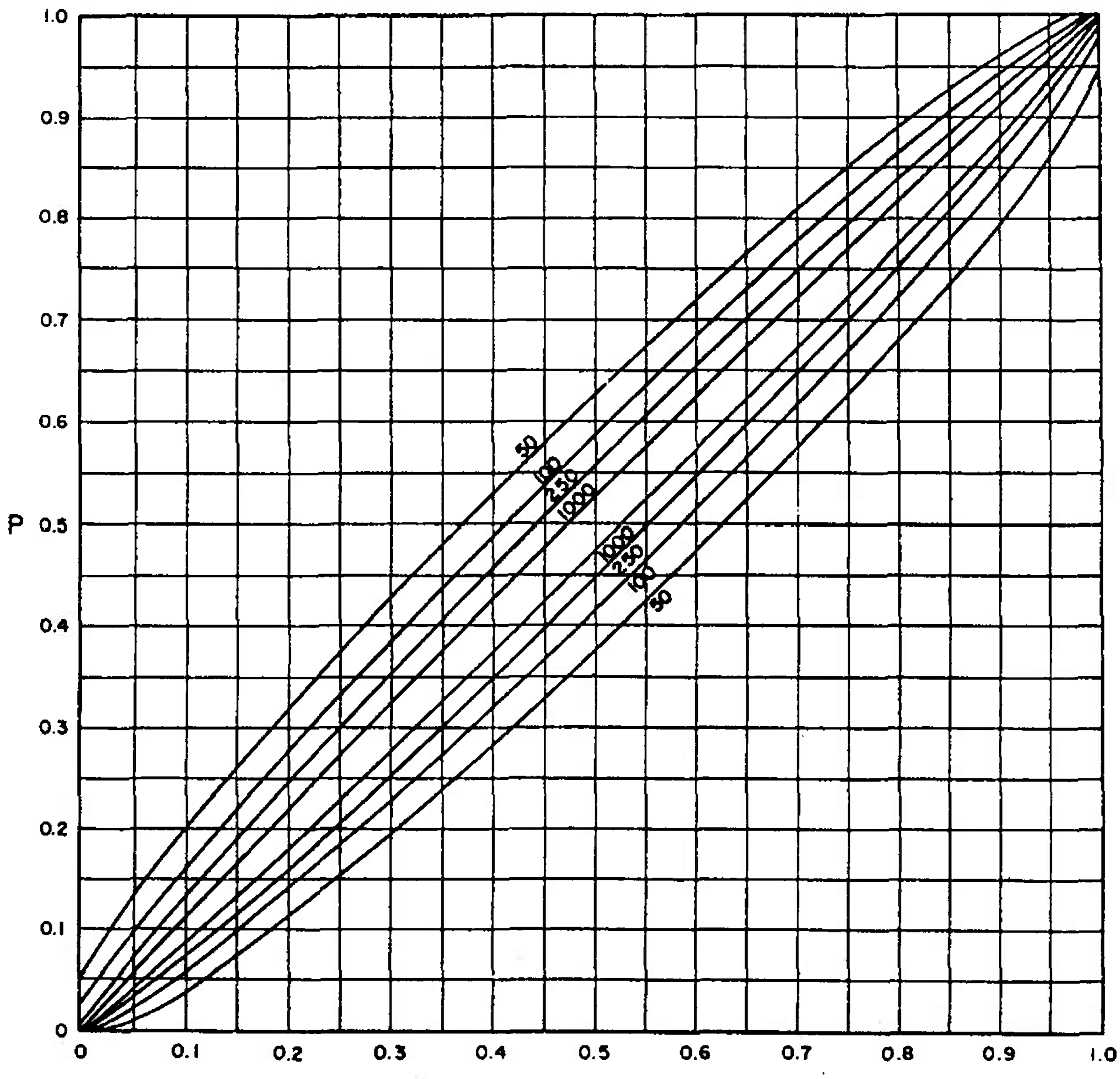

TABLE A-24 (Continued). CONFIDENCE BELTS FOR PROPORTIONS FOR $n > 30$
(CONFIDENCE COEFFICIENT .95)

For tables of confidence limits for $n \leq 30$, see Tables A-22 and A-23

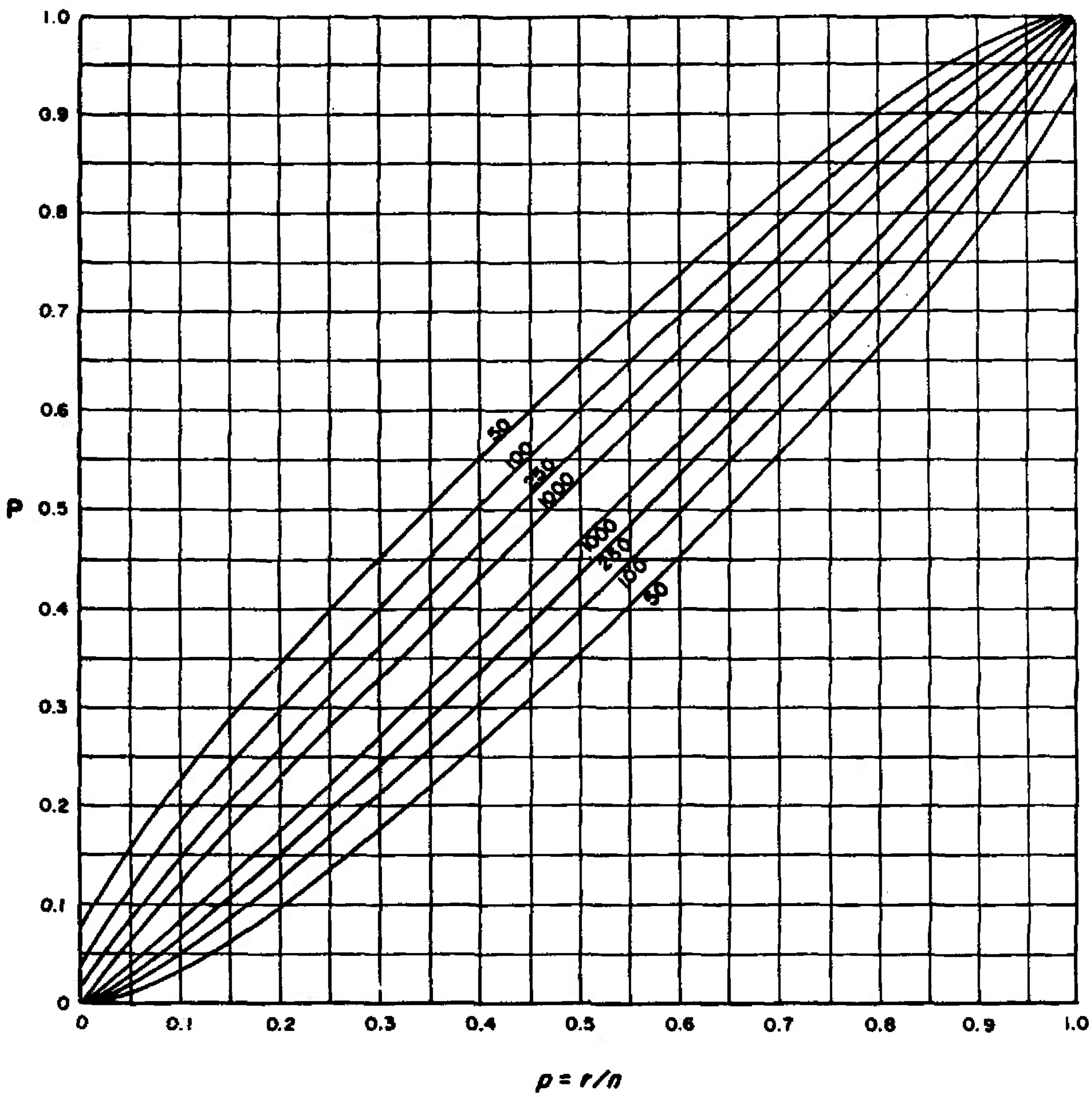

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TABLE A-24 (Continued). CONFIDENCE BELTS FOR PROPORTIONS FOR $n > 30$ (CONFIDENCE COEFFICIENT .99)

For tables of confidence limits for $n \leq 30$, see Tables A-22 and A-23

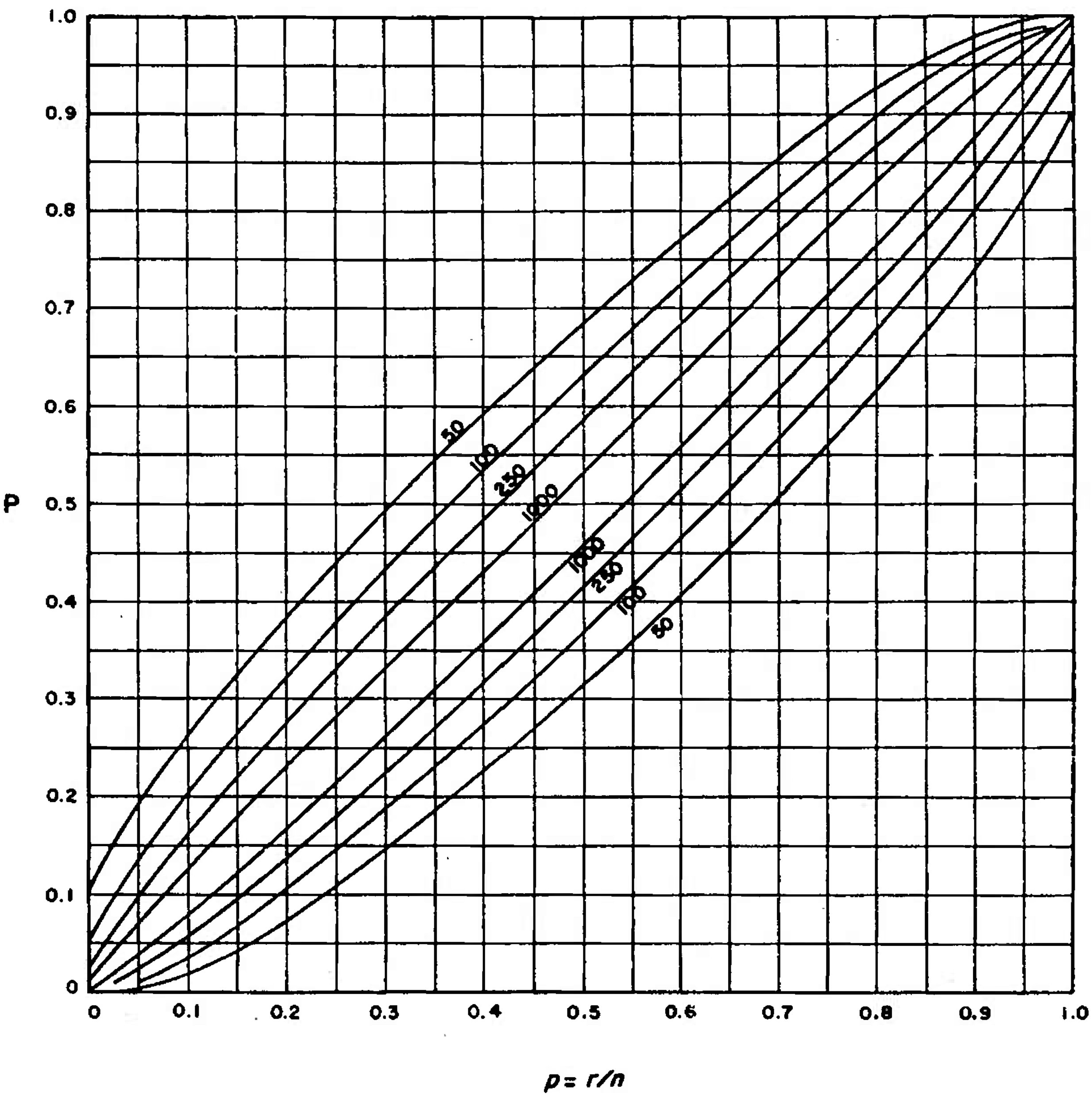

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TABLE A-25. SAMPLE SIZE REQUIRED FOR COMPARING A PROPORTION WITH A STANDARD PROPORTION WHEN THE SIGN OF THE DIFFERENCE IS NOT IMPORTANT

The use of Table A-25 (or equivalent use of Tables A-27 and A-8) is based on the inverse-sine transformation of the binomial to an approximately normal distribution.

Exact determination of required sample size could be made from tables of the binomial distribution, so far as the tables are available. (See *Tables of the Cumulative Binomial Probability Distribution*, Staff, Computation Laboratory, Harvard University, Section IV of the "Introduction" entitled "Applications", Harvard University Press, 1955.)

The entries computed for the tables were rounded to three significant figures, and the rounding was always upward.

These tables also may be used to determine the sample size required for comparing two proportions, as discussed in Chapter 8.

$\alpha = .05, \quad 1 - \beta = .50$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	205	313	1120	—	—	—	—	—	—	—	—	—
.02	80	102	190	551	—	—	—	—	—	—	—	—
.05	26	30	41	62	138	—	—	—	—	—	—	—
.10	12	13	16	20	30	104	—	—	—	—	—	—
.20	6	6	7	8	10	17	48	—	—	—	—	—
.30	4	4	4	5	6	8	15	72	—	—	—	—
.40	3	3	3	3	4	5	8	20	88	—	—	—
.45	2	3	3	3	3	4	6	14	40	376	—	—
.50	2	2	2	3	3	4	5	10	23	95	383	—
.55	2	2	2	2	2	3	4	7	15	43	96	383
.60	2	2	2	2	2	3	4	6	11	24	43	95
.70	2	2	2	2	2	2	3	4	6	11	15	23
.80	1	1	1	1	2	2	2	3	4	6	7	10
.90	1	1	1	1	1	1	2	2	3	4	4	5
1.00	1	1	1	1	1	1	1	1	1	2	2	2

TABLE A-25 (Continued). SAMPLE SIZE REQUIRED FOR COMPARING A PROPORTION WITH A STANDARD PROPORTION WHEN THE SIGN OF THE DIFFERENCE IS NOT IMPORTANT

$\alpha = .05, \quad 1 - \beta = .80$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	419	640	2280	—	—	—	—	—	—	—	—	—
.02	162	208	388	1130	—	—	—	—	—	—	—	—
.05	53	61	82	125	281	—	—	—	—	—	—	—
.10	24	26	32	40	61	212	—	—	—	—	—	—
.20	11	12	13	15	19	35	98	—	—	—	—	—
.30	7	7	8	9	11	16	30	146	—	—	—	—
.40	5	5	6	6	7	10	15	41	178	—	—	—
.45	4	5	5	5	6	8	12	27	82	767	—	—
.50	4	4	4	5	5	7	10	19	47	194	782	—
.55	4	4	4	4	5	6	8	15	30	87	196	782
.60	3	3	3	4	4	5	7	11	21	49	87	194
.70	3	3	3	3	3	4	5	8	12	21	30	47
.80	2	2	2	2	3	3	4	5	8	11	15	19
.90	2	2	2	2	2	2	3	4	5	7	8	10
1.00	1	1	1	1	1	2	2	2	2	3	3	4

$\alpha = .05, \quad 1 - \beta = .90$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	560	857	3040	—	—	—	—	—	—	—	—	—
.02	217	279	520	1510	—	—	—	—	—	—	—	—
.05	70	81	110	168	376	—	—	—	—	—	—	—
.10	32	35	42	54	82	284	—	—	—	—	—	—
.20	15	15	18	20	26	47	131	—	—	—	—	—
.30	9	10	11	12	14	21	40	196	—	—	—	—
.40	7	7	7	8	9	13	20	54	239	—	—	—
.45	6	6	6	7	8	11	16	36	109	1030	—	—
.50	5	5	6	6	7	9	13	26	63	260	1050	—
.55	5	5	5	5	6	8	10	20	41	116	262	1050
.60	4	4	4	5	5	7	9	15	28	65	116	260
.70	3	3	4	4	4	5	6	10	16	28	41	63
.80	3	3	3	3	3	4	5	7	10	15	20	26
.90	2	2	2	2	3	3	4	5	6	9	10	13
1.00	2	2	2	2	2	2	2	3	3	4	4	5

TABLE A-25 (Continued). SAMPLE SIZE REQUIRED FOR COMPARING A PROPORTION WITH A STANDARD PROPORTION WHEN THE SIGN OF THE DIFFERENCE IS NOT IMPORTANT

$\alpha = .05, \quad 1 - \beta = .95$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	693	1060	3760	—	—	—	—	—	—	—	—	—
.02	268	345	642	1870	—	—	—	—	—	—	—	—
.05	87	100	136	207	465	—	—	—	—	—	—	—
.10	39	43	52	67	101	351	—	—	—	—	—	—
.20	18	19	22	25	32	58	162	—	—	—	—	—
.30	11	12	13	15	17	26	49	242	—	—	—	—
.40	8	8	9	10	12	16	25	67	295	—	—	—
.45	7	7	8	9	10	13	19	45	135	1270	—	—
.50	6	6	7	7	8	11	16	32	77	321	1300	—
.55	6	6	6	7	7	9	13	24	50	143	324	1300
.60	5	5	5	6	6	8	11	19	35	81	143	321
.70	4	4	4	5	5	6	8	12	20	35	50	77
.80	3	3	4	4	4	5	6	8	12	19	24	32
.90	3	3	3	3	3	4	4	6	8	11	13	16
1.00	2	2	2	2	2	2	3	3	4	5	5	6

$\alpha = .05, \quad 1 - \beta = .99$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	979	1500	5320	—	—	—	—	—	—	—	—	—
.02	378	487	908	2640	—	—	—	—	—	—	—	—
.05	123	141	192	293	658	—	—	—	—	—	—	—
.10	55	60	73	94	142	496	—	—	—	—	—	—
.20	25	27	30	35	45	81	229	—	—	—	—	—
.30	16	17	18	20	24	37	70	342	—	—	—	—
.40	11	12	13	14	16	22	35	94	417	—	—	—
.45	10	10	11	12	14	18	27	63	190	1800	—	—
.50	9	9	9	10	12	15	22	45	109	453	1830	—
.55	8	8	8	9	10	13	18	34	71	202	458	1830
.60	7	7	7	8	9	11	15	26	49	114	202	453
.70	5	6	6	6	7	8	11	17	28	49	71	109
.80	4	5	5	5	5	6	8	12	17	26	34	45
.90	4	4	4	4	4	5	6	8	11	15	18	22
1.00	2	2	3	3	3	3	3	4	5	6	7	8

TABLE A-26. SAMPLE SIZE REQUIRED FOR COMPARING A PROPORTION WITH A STANDARD PROPORTION WHEN THE SIGN OF THE DIFFERENCE IS IMPORTANT

The use of Table A-26 (or the equivalent use of Tables A-27 and A-9) is based on the inverse-sine transformation of the binomial to an approximately normal distribution.

Exact determination of required sample size could be made from tables of the binomial distribution, so far as the tables are available. (See *Tables of the Cumulative Binomial Distribution*, Staff, Computation Laboratory, Harvard University, Section IV of the "Introduction" entitled "Applications", Harvard University Press, 1955.)

The entries computed for the tables were rounded to three significant figures, and the rounding was always upward.

These tables may also be used to determine the sample size required for comparing two proportions, as discussed in Chapter 8.

$\alpha = .05, \quad 1 - \beta = .50$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	145	221	783	—	—	—	—	—	—	—	—	—
.02	56	72	134	389	—	—	—	—	—	—	—	—
.05	19	21	29	44	97	—	—	—	—	—	—	—
.10	9	9	11	14	21	74	—	—	—	—	—	—
.20	4	4	5	6	7	12	34	—	—	—	—	—
.30	3	3	3	3	4	6	11	51	—	—	—	—
.40	2	2	2	2	3	4	6	14	62	—	—	—
.45	2	2	2	2	2	3	4	10	28	265	—	—
.50	2	2	2	2	2	3	4	7	16	67	270	—
.55	2	2	2	2	2	2	3	5	11	30	68	270
.60	1	1	2	2	2	2	3	4	8	17	30	67
.70	1	1	1	1	1	2	2	3	4	8	11	16
.80	1	1	1	1	1	1	2	2	3	4	5	7
.90	1	1	1	1	1	1	1	2	2	3	3	4
1.00	1	1	1	1	1	1	1	1	1	1	1	2

TABLE A-26 (Continued). SAMPLE SIZE REQUIRED FOR COMPARING A PROPORTION WITH A STANDARD PROPORTION WHEN THE SIGN OF THE DIFFERENCE IS IMPORTANT

$\alpha = .05, \quad 1 - \beta = .80$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	330	504	1790	—	—	—	—	—	—	—	—	—
.02	128	164	306	888	—	—	—	—	—	—	—	—
.05	42	48	65	99	222	—	—	—	—	—	—	—
.10	19	21	25	32	48	167	—	—	—	—	—	—
.20	9	9	11	12	15	28	77	—	—	—	—	—
.30	6	6	6	7	9	13	24	115	—	—	—	—
.40	4	4	5	5	6	8	12	32	141	—	—	—
.45	4	4	4	4	5	6	10	21	64	604	—	—
.50	3	3	4	4	4	5	8	15	37	153	617	—
.55	3	3	3	3	4	5	6	12	24	68	155	617
.60	3	3	3	3	3	4	5	9	17	39	68	153
.70	2	2	2	2	3	3	4	6	10	17	24	37
.80	2	2	2	2	2	2	3	4	6	9	12	15
.90	2	2	2	2	2	2	2	3	4	5	6	8
1.00	1	1	1	1	1	1	1	2	2	2	3	3

$\alpha = .05, \quad 1 - \beta = .90$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	457	698	2480	—	—	—	—	—	—	—	—	—
.02	177	227	424	1230	—	—	—	—	—	—	—	—
.05	57	66	90	137	307	—	—	—	—	—	—	—
.10	26	28	34	44	67	232	—	—	—	—	—	—
.20	12	13	14	17	21	38	107	—	—	—	—	—
.30	8	8	9	10	12	18	33	160	—	—	—	—
.40	6	6	6	7	8	11	17	44	195	—	—	—
.45	5	5	5	6	7	9	13	30	89	837	—	—
.50	4	4	5	5	6	7	10	21	51	212	854	—
.55	4	4	4	4	5	6	9	16	33	95	214	854
.60	3	4	4	4	4	5	7	13	23	53	95	212
.70	3	3	3	3	3	4	5	8	13	23	33	51
.80	2	2	2	3	3	3	4	6	8	13	16	21
.90	2	2	2	2	2	3	3	4	5	7	9	10
1.00	1	1	1	1	2	2	2	2	3	3	4	4

TABLE A-26 (Continued). SAMPLE SIZE REQUIRED FOR COMPARING A PROPORTION WITH A STANDARD PROPORTION WHEN THE SIGN OF THE DIFFERENCE IS IMPORTANT

$\alpha = .05, \quad 1 - \beta = .95$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	577	882	3140	—	—	—	—	—	—	—	—	—
.02	223	287	535	1560	—	—	—	—	—	—	—	—
.05	73	83	113	173	388	—	—	—	—	—	—	—
.10	33	36	43	56	84	293	—	—	—	—	—	—
.20	15	16	18	21	27	48	135	—	—	—	—	—
.30	10	10	11	12	15	22	41	202	—	—	—	—
.40	7	7	8	8	10	13	21	56	246	—	—	—
.45	6	6	7	7	8	11	16	37	112	1060	—	—
.50	5	5	6	6	7	9	13	27	64	267	1080	—
.55	5	5	5	6	6	8	11	20	42	119	270	1080
.60	4	4	5	5	5	7	9	16	29	67	119	267
.70	3	4	4	4	4	5	7	10	16	29	42	64
.80	3	3	3	3	3	4	5	7	10	16	20	27
.90	2	2	2	3	3	3	4	5	7	9	11	13
1.00	2	2	2	2	2	2	2	3	3	4	4	5

$\alpha = .05, \quad 1 - \beta = .99$

Larger Proportion	Smaller Proportion											
	.001	.002	.005	.01	.02	.05	.10	.20	.30	.40	.45	.50
.01	841	1290	4570	—	—	—	—	—	—	—	—	—
.02	325	418	779	2270	—	—	—	—	—	—	—	—
.05	105	121	165	251	565	—	—	—	—	—	—	—
.10	47	52	68	81	122	426	—	—	—	—	—	—
.20	22	23	26	30	39	70	196	—	—	—	—	—
.30	14	14	16	18	21	32	60	293	—	—	—	—
.40	10	10	11	12	14	19	30	81	358	—	—	—
.45	8	9	9	10	12	16	24	54	163	1540	—	—
.50	7	8	8	9	10	13	19	39	94	389	1580	—
.55	7	7	7	8	9	11	15	29	61	174	393	1580
.60	6	6	6	7	8	10	13	23	42	98	174	389
.70	5	5	5	5	6	7	9	15	24	42	61	94
.80	4	4	4	4	5	6	7	10	15	23	29	39
.90	3	3	3	3	4	4	5	7	9	13	15	19
1.00	2	2	2	2	2	3	3	4	5	6	6	7

TABLE A-27. TABLE OF ARC SINE TRANSFORMATION FOR PROPORTIONS

$\theta = 2 \text{ arc sin } \sqrt{P}$

P	θ	P	θ	P	θ	P	θ
.00	.00	.25	1.05	.50	1.57	.75	2.09
.01	.20	.26	1.07	.51	1.59	.76	2.12
.02	.28	.27	1.09	.52	1.61	.77	2.14
.03	.35	.28	1.12	.53	1.63	.78	2.17
.04	.40	.29	1.14	.54	1.65	.79	2.19
.05	.45	.30	1.16	.55	1.67	.80	2.21
.06	.49	.31	1.18	.56	1.69	.81	2.24
.07	.54	.32	1.20	.57	1.71	.82	2.27
.08	.57	.33	1.22	.58	1.73	.83	2.29
.09	.61	.34	1.25	.59	1.75	.84	2.32
.10	.64	.35	1.27	.60	1.77	.85	2.35
.11	.68	.36	1.29	.61	1.79	.86	2.37
.12	.71	.37	1.31	.62	1.81	.87	2.40
.13	.74	.38	1.33	.63	1.83	.88	2.43
.14	.77	.39	1.35	.64	1.85	.89	2.47
.15	.80	.40	1.37	.65	1.88	.90	2.50
.16	.82	.41	1.39	.66	1.90	.91	2.53
.17	.85	.42	1.41	.67	1.92	.92	2.57
.18	.88	.43	1.43	.68	1.94	.93	2.61
.19	.90	.44	1.45	.69	1.96	.94	2.65
.20	.93	.45	1.47	.70	1.98	.95	2.69
.21	.95	.46	1.49	.71	2.00	.96	2.74
.22	.98	.47	1.51	.72	2.03	.97	2.79
.23	1.00	.48	1.53	.73	2.05	.98	2.86
.24	1.02	.49	1.55	.74	2.07	.99	2.94
						1.00	3.14

TABLE A-28. MINIMUM CONTRASTS REQUIRED FOR SIGNIFICANCE IN 2 × 2 TABLES WITH EQUAL SAMPLES

Note that some entries in this table have been omitted in instances where they are easy to supply. For example, see $n_A = n_B = 80$, 5% Level. There is an entry (16,29) followed by an entry (23,36). The difference between the first numbers of these pairs is the same as the difference between the second numbers of the pairs. Thus contrast pairs (17,30), (18,31), (19,32), etc., are also significant contrasts, but have been omitted to save space.

In many cases this table can be used to give a good idea of the significance of an observed contrast for values of n intermediate to those tabulated. For example, consider two samples of $n = 320$ items each:

	Class I	Class II	Total
Sample A	92	228	320
Sample B	117	203	320

We find the entry (95,119) in the table for $n = 300$, hence (92,116) is a significant contrast for $n = 300$. For $n = 400$, we find (100,126), hence (92,118) is a significant contrast for $n = 400$. We conclude that the observed contrast (92,117) is approximately significant at the 5% level.

If this method is not considered sufficient in a particular case, use the χ^2 method described in Chapter 8. The χ^2 method is an approximation which gives good results for cases not covered by this table.

5% Level, Two-Sided (Is P_A different from P_B?) 2.5% Level, One-Sided (Is P_A larger than P_B?)					1% Level, Two-Sided (Is P_A different from P_B?) 0.5% Level, One-Sided (Is P_A larger than P_B?)			
Sample Size $n_A = n_B$	A_1, A_2				Sample Size $n_A = n_B$	A_1, A_2		
4	0,4							
5	0,4				5	0,5		
6	0,5				6	0,6		
7	0,5	1,6			7	0,6		
8	0,5	1,6			8	0,6		
9	0,5	1,6			9	0,6	1,8	
10	0,5	1,7	2,8		10	0,7	1,8	
11	0,5	1,7	2,8		11	0,7	1,8	2,9
12	0,5	1,7	2,8	3,9	12	0,7	1,8	2,10

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TABLE A-28 (Continued). MINIMUM CONTRASTS REQUIRED FOR SIGNIFICANCE IN 2 × 2 TABLES WITH EQUAL SAMPLES

5% Level, Two-Sided (Is P_A different from P_B?) 2.5% Level, One-Sided (Is P_A larger than P_B?)					1% Level, Two-Sided (Is P_A different from P_B?) 0.5% Level, One-Sided (Is P_A larger than P_B?)				
Sample Size $n_A = n_B$	A_1, A_2				Sample Size $n_A = n_B$	A_1, A_2			
13	0,5	1,7	2,8	3,9	13	0,7	1,9	2,10	
14	0,5	1,7	2,8	3,10	14	0,7	1,9	2,10	3,11
15	0,5	1,7	2,9	3,10	15	0,7	1,9	2,10	3,11
				4,11					
16	0,5	1,7	2,9	3,10	16	0,7	1,9	2,10	3,12
	4,11								
17	0,5	1,7	2,9	3,10	17	0,7	1,9	2,11	3,12
	4,11	5,12				4,13			
18	0,5	1,7	2,9	3,10	18	0,7	1,9	2,11	3,12
	4,11	5,12				4,13			
19	0,5	1,7	2,9	3,10	19	0,7	1,9	2,11	3,12
	4,11	5,12				4,13	5,14		
20	0,5	1,7	2,9	3,10	20	0,7	1,9	2,11	3,12
	4,11	5,13	6,14			4,13	5,15		
30	0,6	1,8	2,9	3,11	30	0,8	1,10	2,12	3,13
	4,12	5,13	6,15	7,16		4,15	9,20		
	8,17	9,18	10,19						
40	0,6	1,8	2,9	3,11	40	0,8	1,10	2,12	3,14
	4,12	5,14	6,15	7,16		4,15	5,17	8,20	9,22
	8,18	9,19	10,20	15,25		13,26			
50	0,6	1,8	2,10	3,11	50	0,8	1,10	2,12	3,14
	4,13	5,14	6,15	7,17		4,15	5,17	6,18	7,20
	8,18	9,19	10,20	11,22		9,22	10,24	18,32	
	19,30								
60	0,6	1,8	2,10	3,11	60	0,8	1,10	2,12	3,14
	4,13	5,14	6,16	7,17		4,16	5,17	6,19	8,21
	8,18	9,20	10,21	11,22		9,23	11,25	12,27	19,34
	12,23	13,24	14,26	24,36		20,36	22,38		

TABLE A-28 (Continued). MINIMUM CONTRASTS REQUIRED FOR SIGNIFICANCE IN 2×2 TABLES WITH EQUAL SAMPLES

5% Level, Two-Sided (Is P_A different from P_B?)
2.5% Level, One-Sided (Is P_A larger than P_B?)

Sample Size $n_A = n_B$	A_1, A_2			
70	0,6	1,8	2,10	3,11
	4,13	5,14	6,16	7,17
	8,18	9,20	10,21	11,22
	12,23	13,25	18,30	19,32
	20,33	28,41		
80	0,6	1,8	2,10	3,11
	4,13	5,14	6,16	7,17
	8,19	9,20	10,21	11,22
	12,24	13,25	14,26	15,27
	16,29	23,36	24,38	33,47
90	0,6	1,8	2,10	3,11
	4,13	5,14	6,16	7,17
	8,19	9,20	10,21	11,23
	12,24	13,25	14,26	15,28
	20,33	21,35	31,45	32,47
	37,52			
100	0,6	1,8	2,10	3,11
	4,13	5,15	6,16	7,17
	8,19	9,20	10,21	11,23
	12,24	13,25	14,27	18,31
	19,33	25,39	26,41	42,57
150	0,6	1,8	2,10	3,12
	4,13	5,15	6,16	7,18
	8,19	9,20	10,22	11,23
	12,24	13,26	14,27	15,28
	16,30	19,33	20,35	25,40
	26,42	32,48	33,50	41,58
	42,60	66,84		
200	0,6	1,8	2,10	3,12
	4,13	5,15	6,16	7,18
	8,19	9,21	10,22	11,23
	12,25	13,26	14,27	15,29
	18,32	19,34	22,37	23,39
	27,43	28,45	33,50	34,52
	41,59	42,61	51,70	52,72
	65,85	66,87	89,110	

1% Level, Two-Sided (Is P_A different from P_B?)
0.5% Level, One-Sided (Is P_A larger than P_B?)

Sample Size $n_A = n_B$	A_1, A_2			
70	0,8	1,10	2,12	3,14
	4,16	5,17	6,19	7,20
	8,22	10,24	11,26	14,29
	15,31	21,37	22,39	26,43
80	0,8	1,10	2,12	3,14
	4,16	5,18	6,19	7,21
	9,23	10,25	12,27	13,29
	16,32	17,34	24,41	25,43
	31,49			
90	0,8	1,10	2,12	3,14
	4,16	5,18	6,19	7,21
	8,22	9,24	11,26	12,28
	15,31	16,33	19,36	20,38
	28,46	29,48	35,54	
100	0,8	1,10	2,13	3,14
	4,16	5,18	6,19	7,21
	8,22	9,24	10,25	11,27
	14,30	15,32	18,35	19,37
	23,41	24,43	33,52	34,54
	40,60			
150	0,8	1,11	2,13	3,15
	4,16	5,18	6,20	7,21
	8,23	9,24	10,26	11,27
	12,29	14,31	15,33	17,35
	18,37	21,40	22,42	26,46
	27,48	31,52	32,54	39,61
	40,63	51,74	52,76	63,87
200	0,8	1,11	2,13	3,15
	4,16	5,18	6,20	7,21
	8,23	9,24	10,26	11,27
	12,29	13,30	14,32	16,34
	17,36	19,38	20,40	23,43
	24,45	26,47	27,49	31,53
	32,55	36,59	37,61	43,67
	44,69	51,76	52,78	63,89
	64,91	86,113		

TABLE A-28 (Continued). MINIMUM CONTRASTS REQUIRED FOR SIGNIFICANCE IN 2 × 2 TABLES WITH EQUAL SAMPLES

5% Level, Two-Sided (Is P_A different from P_B?)
2.5% Level, One-Sided (Is P_A larger than P_B?)

Sample Size $n_A = n_B$	A_1, A_2			
300	0,6	1,8	2,10	3,12
	4,13	5,15	6,16	7,18
	8,19	9,21	10,22	11,24
	12,25	13,26	14,28	15,29
	16,30	17,31	18,33	19,34
	20,35	21,37	24,40	25,42
	29,46	30,48	35,53	36,55
	41,60	42,62	48,68	49,70
	56,77	57,79	66,88	67,90
	78,101	79,103	95,119	96,121
	137,162			
400	0,6	1,8	2,10	3,12
	4,13	5,15	6,17	7,18
	8,19	9,21	10,22	11,24
	12,25	13,26	14,28	15,29
	16,30	17,32	20,35	21,37
	24,40	25,42	28,45	29,47
	33,51	34,53	38,57	39,59
	44,64	45,66	51,72	52,74
	58,80	59,82	67,90	68,92
	76,100	77,102	87,112	88,114
	100,126	101,128	117,144	118,146
	141,169	142,171	185,214	
500	0,6	1,8	2,10	3,12
	4,13	5,15	6,17	7,18
	8,19	9,21	10,22	11,24
	12,25	13,26	14,28	15,29
	16,30	17,32	18,33	19,34
	20,36	23,39	24,41	27,44
	28,46	32,50	33,52	37,56
	38,58	42,62	43,64	48,69
	49,71	55,77	56,79	62,85
	63,87	70,94	71,96	79,104
	80,106	89,115	90,117	100,127
	101,129	113,141	114,143	128,157
	129,159	147,177	148,179	172,203
	178,205	234,266		

1% Level, Two-Sided (Is P_A different from P_B?)
0.5% Level, One-Sided (Is P_A larger than P_B?)

Sample Size $n_A = n_B$	A_1, A_2			
300	0,8	1,11	2,13	3,15
	4,17	5,18	6,20	7,22
	8,23	9,25	10,26	11,28
	12,29	13,31	15,33	16,35
	17,36	18,38	20,40	21,42
	23,44	24,46	27,49	28,51
	31,54	32,56	35,59	36,61
	40,65	41,67	45,71	46,73
	51,78	52,80	58,86	59,88
	66,95	67,97	76,106	77,108
	88,119	89,121	107,139	108,141
	133,166			
400	0,8	1,11	2,13	3,15
	4,17	5,18	6,20	7,22
	8,23	9,25	10,26	11,28
	12,29	13,31	14,32	15,34
	17,36	18,38	19,39	20,41
	22,43	23,45	26,48	27,50
	29,52	30,54	33,57	34,59
	37,62	38,64	41,67	42,69
	46,73	47,75	52,80	53,82
	57,86	58,88	64,94	65,96
	71,102	72,104	79,111	80,113
	88,121	89,123	98,132	99,134
	111,146	112,148	127,163	128,165
	152,189	153,191	181,219	
500	0,8	1,11	2,13	3,15
	4,17	5,18	6,20	7,22
	8,24	9,25	10,27	11,28
	12,30	14,32	15,34	16,35
	17,37	19,39	20,41	22,43
	23,45	25,47	26,49	28,51
	29,53	32,56	33,58	35,60
	36,62	40,66	41,68	44,71
	45,73	49,77	50,79	54,83
	55,85	59,89	60,91	65,96
	66,98	72,104	73,106	79,112
	80,114	86,120	87,122	95,130
	96,132	104,140	105,142	115,152
	116,154	127,165	128,167	141,180
	142,182	159,199	160,201	184,225
	185,227	229,271		

TABLES

TABLE A-29. TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

Table A-29 shows (1) in bold type for given a_1, n_1, and n_2, the value of a_2 which is just significant at the probability level quoted in parentheses for a two-sided test and without parentheses for a one-sided test, (2) in small type, for given n_1, n_2 and $a_1 + a_2$, the exact probability (if there is independence) that a_2 is equal to or less than the integer shown in bold type.

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=3$ $n_2=3$	3	**0** .050	—	—	—
$n_1=4$ $n_2=4$	4	**0** .014	**0** .014	—	—
3	4	**0** .029	—	—	—
$n_1=5$ $n_2=5$	5	**1** .024	**1** .024	**0** .004	**0** .004
	4	**0** .024	**0** .024	—	—
4	5	**1** .048	**0** .008	**0** .008	—
	4	**0** .040	—	—	—
3	5	**0** .018	**0** .018	—	—
2	5	**0** .048	—	—	—
$n_1=6$ $n_2=6$	6	**2** .030	**1** .008	**1** .008	**0** .001
	5	**1** .040	**0** .008	**0** .008	—
	4	**0** .020	—	—	—
5	6	**1** .015 +	**1** .015 +	**0** .002	**0** .002
	5	**0** .013	**0** .013	—	—
	4	**0** .045 +	—	—	—
4	6	**1** .033	**0** .005 −	**0** .005 −	**0** .005 −
	5	**0** .024	**0** .024	—	—
3	6	**0** .012	**0** .012	—	—
	5	**0** .045	—	—	—
2	6	**0** .036	—	—	—
$n_1=7$ $n_2=7$	7	**3** .035 −	**2** .010 +	**1** .002	**1** .002
	6	**1** .015 −	**1** .015 −	**0** .002	**0** .002
	5	**0** .010 +	**0** .010 +	—	—
	4	**0** .035 −	—	—	—
6	7	**2** .021	**2** .021	**1** .005 −	**1** .005 −
	6	**1** .025 +	**0** .004	**0** .004	**0** .004
	5	**0** .015	**0** .015	—	—
	4	**0** .045	—	—	—
5	7	**2** .045 +	**1** .010 +	**0** .001	**0** .001
	6	**1** .045 +	**0** .008	**0** .005	—
	5	**0** .027	—	—	—
4	7	**1** .024	**1** .024	**0** .003	**0** .003
	6	**0** .015 +	**0** .015 +	—	—
	5	**0** .045 +	—	—	—
3	7	**0** .008	**0** .008	**0** .008	—
	6	**0** .033	—	—	—
2	7	**0** .028	—	—	—
$n_1=8$ $n_2=8$	8	**4** .038	**3** .013	**2** .003	**2** .003
	7	**2** .020	**2** .020	**1** .005 +	**0** .001
	6	**1** .020	**1** .020	**0** .003	**0** .003
	5	**0** .013	**0** .013	—	—
	4	**0** .038	—	—	—
7	8	**3** .026	**2** .007	**2** .007	**1** .001
	7	**2** .035 −	**1** .009	**1** .009	**0** .001
	6	**1** .032	**0** .006	**0** .006	—
	5	**0** .019	**0** .019	—	—
6	8	**2** .015 −	**2** .015 −	**1** .003	**1** .003
	7	**1** .016	**1** .016	**0** .002	**0** .002
	6	**0** .009	**0** .009	**0** .009	—
	5	**0** .025	—	—	—
5	8	**2** .035 −	**1** .007	**1** .007	**0** .001
	7	**1** .032	**0** .005 −	**0** .005 −	**0** .005 −
	6	**0** .015	**0** .016	—	—
	5	**0** .044	—	—	—
4	8	**1** .018	**1** .018	**0** .002	**0** .002
	7	**0** .010 +	**0** .010 +	—	—
	6	**0** .030	—	—	—
3	8	**0** .006	**0** .006	**0** .006	—
	7	**0** .024	**0** .024	—	—
2	8	**0** .022	**0** .022	—	—
$n_1=9$ $n_2=9$	9	**5** .041	**4** .015 −	**3** .005 −	**3** .005 −
	8	**3** .025 −	**3** .025 −	**2** .005	**1** .002
	7	**2** .028	**1** .005	**1** .005	**0** .001
	6	**1** .025 −	**1** .025 −	**0** .005 −	**0** .005 −
	5	**0** .015 −	**0** .015 −	—	—
	4	**0** .041	—	—	—
8	9	**4** .029	**3** .009	**3** .009	**2** .002
	8	**3** .043	**2** .013	**1** .003	**1** .003
	7	**2** .044	**1** .012	**0** .002	**0** .002
	6	**1** .035	**0** .007	**0** .007	—
	5	**0** .020	**0** .020	—	—
7	9	**3** .019	**3** .019	**2** .005 −	**2** .005 −
	8	**2** .024	**2** .024	**1** .006	**0** .001
	7	**1** .020	**1** .020	**0** .003	**0** .003
	6	**0** .010 +	**0** .010 +	—	—
	5	**0** .029	—	—	—
6	9	**2** .044	**2** .011	**1** .002	**1** .002
	8	**2** .047	**1** .011	**0** .001	**0** .001
	7	**1** .035 −	**0** .006	**0** .006	—
	6	**0** .017	**0** .017	—	—
	5	**0** .042	—	—	—

Adapted from a table of the same form with probabilities to 4 decimals prepared in the Statistical Engineering Laboratory, National Bureau of Standards, by Anna M. Glinski and John Van Dyke from *Tables of the Hypergeometric Probability Distribution* by Gerald J. Lieberman and Donald B. Owen, Technical Report No. 50 (Contract Nonr-225(53) (NR 042 002)), Applied Mathematics and Statistics Laboratories, Stanford University, Stanford, California.

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 9$ $n_2 = 5$	9	2 .027	1 .005 –	1 .005 –	1 .005 –
	8	1 .022	1 .022	0 .003	0 .003
	7	0 .010 +	0 .010 +	—	—
	6	0 .028	—	—	—
4	9	1 .014	1 .014	0 .001	0 .001
	8	0 .007	0 .007	0 .007	—
	7	0 .021	0 .021	—	—
	6	0 .049	—	—	—
3	9	1 .045 +	0 .005 –	0 .005 –	0 .005 –
	8	0 .015	0 .015	—	—
	7	0 .045 +	—	—	—
2	9	0 .018	0 .018	—	—
$n_1 = 10$ $n_2 = 10$	10	6 .043	5 .016	4 .005 +	3 .002
	9	4 .029	3 .010 –	3 .010 –	2 .003
	8	3 .035 –	2 .012	1 .003	1 .003
	7	2 .035 –	1 .010 –	1 .010 –	0 .002
	6	1 .029	0 .005 +	0 .005 +	—
	5	0 .016	0 .016	—	—
	4	0 .043	—	—	—
9	10	5 .033	4 .011	3 .003	3 .003
	9	4 .050 –	3 .017	2 .005 –	2 .005 –
	8	2 .019	2 .019	1 .004	1 .004
	7	1 .015 –	1 .015 –	0 .002	0 .002
	6	1 .040	0 .008	0 .008	—
	5	0 .022	0 .022	—	—
8	10	4 .023	4 .023	3 .007	2 .002
	9	3 .032	2 .009	2 .009	1 .002
	8	2 .031	1 .008	1 .008	0 .001
	7	1 .023	1 .023	0 .004	0 .004
	6	0 .011	0 .011	—	—
	5	0 .029	—	—	—
7	10	3 .015 –	3 .015 –	2 .003	2 .003
	9	2 .018	2 .018	1 .004	1 .004
	8	1 .013	1 .013	0 .002	0 .002
	7	1 .036	0 .006	0 .006	—
	6	0 .017	0 .017	—	—
	5	0 .041	—	—	—
6	10	3 .028	2 .008	2 .008	1 .001
	9	2 .026	1 .008	1 .008	0 .001
	8	1 .024	1 .024	0 .003	0 .003
	7	0 .010 +	0 .010 +	—	—
	6	0 .028	—	—	—
5	10	2 .022	2 .022	1 .004	1 .004
	9	1 .017	1 .017	0 .002	0 .002
	8	1 .047	0 .007	0 .007	—
	7	0 .019	0 .019	—	—
	6	0 .042	—	—	—
$n_1 = 10$ $n_2 = 4$	10	1 .011	1 .011	0 .001	0 .001
	9	1 .041	0 .005 –	0 .005 –	0 .005 –
	8	0 .015 –	0 .015 –	—	—
	7	0 .025 –	—	—	—
3	10	1 .028	0 .003	0 .003	0 .003
	9	0 .014	0 .014	—	—
	8	0 .025 –	—	—	—
2	10	0 .015 +	0 .015 +	—	—
	9	0 .045 +	—	—	—
$n_1 = 11$ $n_2 = 11$	11	7 .045 +	6 .018	5 .006	4 .002
	10	5 .032	4 .012	3 .004	3 .004
	9	4 .040	3 .015 –	2 .004	2 .004
	8	3 .043	2 .015 –	1 .004	1 .004
	7	2 .040	1 .012	0 .002	0 .002
	6	1 .032	0 .006	0 .006	—
	5	0 .018	0 .018	—	—
	4	0 .045 +	—	—	—
10	11	6 .035 +	5 .012	4 .004	4 .004
	10	4 .021	4 .021	3 .007	2 .002
	9	3 .024	3 .024	2 .007	1 .002
	8	2 .023	2 .022	1 .006	0 .001
	7	1 .017	1 .017	0 .003	0 .003
	6	1 .043	0 .009	0 .009	—
	5	0 .023	0 .023	—	—
9	11	5 .026	4 .008	4 .008	3 .002
	10	4 .035	3 .012	2 .003	2 .003
	9	3 .040	2 .012	1 .003	1 .003
	8	2 .035 –	1 .009	1 .009	0 .001
	7	1 .025 –	1 .025 –	0 .004	0 .004
	6	0 .012	0 .012	—	—
	5	0 .030	—	—	—
8	11	4 .015	4 .015	3 .005 –	3 .005 –
	10	3 .024	3 .024	2 .008	1 .001
	9	2 .022	2 .022	1 .005 –	1 .005 –
	8	1 .015 –	1 .015 –	0 .002	0 .002
	7	1 .037	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .040	—	—	—
7	11	4 .043	3 .011	2 .002	2 .002
	10	3 .047	2 .013	1 .002	1 .002
	9	2 .039	1 .009	1 .009	0 .001
	8	1 .025 –	1 .025 –	0 .004	0 .004
	7	0 .010 +	0 .010 +	—	—
	6	0 .025 –	0 .025 –	—	—
6	11	3 .029	2 .006	2 .006	1 .001
	10	2 .025	1 .005 +	1 .005 +	0 .001
	9	1 .018	1 .018	0 .002	0 .002

TABLES

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=9$ $n_2=5$	9	2 .027	1 .005 −	1 .005 −	1 .005 −
	8	1 .023	1 .023	0 .003	0 .003
	7	0 .010 +	0 .010 +	—	—
	6	0 .028	—	—	—
4	9	1 .014	1 .014	0 .001	0 .001
	8	0 .007	0 .007	0 .007	—
	7	0 .031	0 .021	—	—
	6	0 .049	—	—	—
3	9	1 .045 +	0 .005 −	0 .005 −	0 .005 −
	8	0 .018	0 .018	—	—
	7	0 .045 +	—	—	—
2	9	0 .018	0 .018	—	—
$n_1=10$ $n_2=10$	10	6 .043	5 .016	4 .005 +	3 .002
	9	4 .029	3 .010 −	3 .010 −	2 .003
	8	3 .035 −	2 .012	1 .003	1 .003
	7	2 .035 −	1 .010 −	1 .010 −	0 .002
	6	1 .029	0 .005 +	0 .005 +	—
	5	0 .016	0 .016	—	—
	4	0 .043	—	—	—
9	10	5 .033	4 .011	3 .003	3 .003
	9	4 .050 −	3 .017	2 .005 −	2 .005 −
	8	2 .019	2 .019	1 .004	1 .004
	7	1 .015 −	1 .015 −	0 .002	0 .002
	6	1 .040	0 .008	0 .008	—
	5	0 .022	0 .022	—	—
8	10	4 .023	4 .023	3 .007	2 .002
	9	3 .032	2 .009	2 .009	1 .002
	8	2 .031	1 .008	1 .008	0 .001
	7	1 .023	1 .023	0 .004	0 .004
	6	0 .011	0 .011	—	—
	5	0 .029	—	—	—
7	10	3 .015 −	3 .015 −	2 .003	2 .003
	9	2 .018	2 .018	1 .004	1 .004
	8	1 .013	1 .013	0 .002	0 .002
	7	1 .038	0 .008	0 .008	—
	6	0 .017	0 .017	—	—
	5	0 .041	—	—	—
6	10	3 .038	2 .008	2 .008	1 .001
	9	2 .026	1 .008	1 .008	0 .001
	8	1 .024	1 .024	0 .003	0 .003
	7	0 .010 +	0 .010 +	—	—
	6	0 .026	—	—	—
5	10	2 .022	2 .022	1 .004	1 .004
	9	1 .017	1 .017	0 .002	0 .002
	8	1 .047	0 .007	0 .007	—
	7	0 .019	0 .019	—	—
	6	0 .042	—	—	—
$n_1=10$ $n_2=4$	10	1 .011	1 .011	0 .001	0 .001
	9	1 .041	0 .005 −	0 .005 −	0 .005 −
	8	0 .015 −	0 .015 −	—	—
	7	0 .035 −	—	—	—
3	10	1 .038	0 .003	0 .003	0 .003
	9	0 .014	0 .014	—	—
	8	0 .035 −	—	—	—
2	10	0 .015 +	0 .015 +	—	—
	9	0 .045 +	—	—	—
$n_1=11$ $n_2=11$	11	7 .045 +	6 .018	5 .006	4 .002
	10	5 .032	4 .012	3 .004	3 .004
	9	4 .040	3 .015 −	2 .004	2 .004
	8	3 .043	2 .015 −	1 .004	1 .004
	7	2 .040	1 .012	0 .002	0 .002
	6	1 .032	0 .006	0 .006	—
	5	0 .018	0 .018	—	—
	4	0 .045 +	—	—	—
10	11	6 .035 +	5 .012	4 .004	4 .004
	10	4 .021	4 .021	3 .007	2 .002
	9	3 .024	3 .024	2 .007	1 .002
	8	2 .023	2 .022	1 .006	0 .001
	7	1 .017	1 .017	0 .003	0 .003
	6	1 .043	0 .009	0 .009	—
	5	0 .023	0 .023	—	—
9	11	5 .026	4 .008	4 .008	3 .002
	10	4 .038	3 .012	2 .003	2 .003
	9	3 .040	2 .012	1 .003	1 .003
	8	2 .035 −	1 .009	1 .009	0 .001
	7	1 .025 −	1 .025 −	0 .004	0 .004
	6	0 .012	0 .012	—	—
	5	0 .020	—	—	—
8	11	4 .018	4 .018	3 .005 −	3 .005 −
	10	3 .024	3 .024	2 .006	1 .001
	9	2 .022	2 .022	1 .005 −	1 .005 −
	8	1 .015 −	1 .015 −	0 .002	0 .002
	7	1 .037	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .040	—	—	—
7	11	4 .043	3 .011	2 .002	2 .002
	10	3 .047	2 .013	1 .002	1 .002
	9	2 .039	1 .009	1 .009	0 .001
	8	1 .025 −	1 .025 −	0 .004	0 .004
	7	0 .010 +	0 .010 +	—	—
	6	0 .025 −	0 .025 −	—	—
6	11	3 .039	2 .008	2 .008	1 .001
	10	2 .028	1 .005 +	1 .005 +	0 .001
	9	1 .018	1 .018	0 .002	0 .002

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 11$ $n_2 = 6$	8	1 .043	0 .007	0 .007	—
	7	0 .017	0 .017	—	—
	6	0 .037	—	—	—
5	11	2 .018	2 .018	1 .003	1 .003
	10	1 .013	1 .013	0 .001	0 .001
	9	1 .036	0 .005 –	0 .005 –	0 .005 –
	8	0 .013	0 .013	—	—
	7	0 .029	—	—	—
4	11	1 .009	1 .009	1 .009	0 .001
	10	1 .033	0 .004	0 .004	0 .004
	9	0 .011	0 .011	—	—
	8	0 .026	—	—	—
3	11	1 .033	0 .003	0 .003	0 .003
	10	0 .011	0 .011	—	—
	9	0 .027	—	—	—
2	11	0 .013	0 .013	—	—
	10	0 .036	—	—	—
$n_1 = 12$ $n_2 = 12$	12	8 .047	7 .019	6 .007	5 .002
	11	6 .034	5 .014	4 .005 –	4 .005 –
	10	5 .045 –	4 .018	3 .006	2 .002
	9	4 .050 –	3 .020	2 .006	1 .001
	8	3 .050 –	2 .018	1 .005 –	1 .005 –
	7	2 .045 –	1 .014	0 .002	0 .002
	6	1 .034	0 .007	0 .007	—
	5	0 .019	0 .019	—	—
	4	0 .047	—	—	—
11	12	7 .037	6 .014	5 .005 –	5 .005 –
	11	5 .024	5 .024	4 .006	3 .002
	10	4 .029	3 .010 +	2 .003	2 .003
	9	3 .030	2 .009	2 .009	1 .002
	8	2 .026	1 .007	1 .007	0 .001
	7	1 .019	1 .019	0 .003	0 .003
	6	1 .045 –	0 .009	0 .009	—
	5	0 .024	0 .024	—	—
10	12	6 .029	5 .010 –	5 .010 –	4 .003
	11	5 .043	4 .016 +	3 .005 –	3 .005 –
	10	4 .048	3 .017	2 .005 –	2 .005 –
	9	3 .046	2 .015 –	1 .004	1 .004
	8	2 .038	1 .010 +	0 .002	0 .002
	7	1 .026	0 .005 –	0 .005 –	0 .005 –
	6	0 .012	0 .012	—	—
	5	0 .030	—	—	—
9	12	5 .021	5 .021	4 .006	3 .002
	11	4 .029	3 .009	3 .009	2 .002
	10	3 .029	2 .006	2 .006	1 .002
	9	2 .024	2 .024	1 .006	0 .001
	8	1 .016	1 .016	0 .002	0 .002
$n_1 = 12$ $n_2 = 9$	7	1 .037	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .039	—	—	—
8	12	5 .049	4 .014	3 .004	3 .004
	11	3 .018	3 .018	2 .004	2 .004
	10	2 .015 +	2 .015 +	1 .003	1 .003
	9	2 .040	1 .010 –	1 .010 –	0 .001
	8	1 .025 –	1 .025 –	0 .004	0 .004
	7	0 .010 +	0 .010 +	—	—
	6	0 .024	0 .024	—	—
7	12	4 .036	3 .009	3 .009	2 .002
	11	3 .038	2 .010 –	2 .010 –	1 .002
	10	2 .029	1 .006	1 .006	0 .001
	9	1 .017	1 .017	0 .002	0 .002
	8	1 .040	0 .007	0 .007	—
	7	0 .016	0 .016	—	—
	6	0 .034	—	—	—
6	12	3 .025 –	3 .025 –	2 .005 –	2 .005 –
	11	2 .022	2 .022	1 .004	1 .004
	10	1 .013	1 .013	0 .002	0 .002
	9	1 .032	0 .005 –	0 .005 –	0 .005 –
	8	0 .011	0 .011	—	—
	7	0 .025 –	0 .025 –	—	—
	6	0 .050 –	—	—	—
5	12	2 .015 –	2 .016 –	1 .002	1 .002
	11	1 .010 –	1 .010 –	1 .010 –	0 .001
	10	1 .028	0 .003	0 .003	0 .003
	9	0 .009	0 .009	0 .009	—
	8	0 .020	0 .020	—	—
	7	0 .041	—	—	—
4	12	2 .050	1 .007	1 .007	0 .001
	11	1 .027	0 .003	0 .003	0 .003
	10	0 .008	0 .008	0 .008	—
	9	0 .019	0 .019	—	—
	8	0 .038	—	—	—
3	12	1 .029	0 .002	0 .002	0 .002
	11	0 .009	0 .009	0 .009	—
	10	0 .022	0 .022	—	—
	9	0 .044	—	—	—
2	12	0 .011	0 .011	—	—
	11	0 .033	—	—	—
$n_1 = 13$ $n_2 = 13$	13	9 .048	8 .020	7 .007	6 .003
	12	7 .037	6 .015 +	5 .006	4 .002
	11	6 .046	5 .021	4 .008	3 .002
	10	4 .024	4 .024	3 .008	2 .002
	9	3 .024	3 .024	2 .008	1 .002
	8	2 .021	2 .021	1 .006	0 .001

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

		Significance Level			
	a_1	0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=13$ $n_2=13$	7	2 .048	1 .018 +	0 .003	0 .002
	6	1 .037	0 .007	0 .007	—
	5	0 .020	0 .020	—	—
	4	0 .048	—	—	—
12	13	8 .039	7 .015 –	6 .005 +	5 .002
	12	6 .027	5 .010 –	5 .010 –	4 .003
	11	5 .033	4 .013	3 .004	3 .004
	10	4 .036	3 .012	2 .004	2 .004
	9	3 .054	2 .011	1 .003	1 .003
	8	2 .029	1 .008	1 .008	0 .001
	7	1 .020	1 .020	0 .004	0 .004
	6	1 .046	0 .010 –	0 .010 –	—
	5	0 .024	0 .024	—	—
11	13	7 .031	6 .011	5 .003	5 .003
	12	6 .048	5 .018	4 .008	3 .002
	11	4 .021	4 .021	3 .007	2 .002
	10	3 .021	3 .021	2 .006	1 .001
	9	3 .050 –	2 .017	1 .004	1 .004
	8	2 .040	1 .011	0 .002	0 .002
	7	1 .027	0 .005 –	0 .005 –	0 .005 –
	6	0 .013	0 .013	—	—
	5	0 .020	—	—	—
10	13	6 .024	6 .024	5 .007	4 .002
	12	5 .035 –	4 .012	3 .003	3 .002
	11	4 .037	3 .013	2 .003	2 .003
	10	3 .033	2 .010 +	1 .002	1 .002
	9	2 .026	1 .006	1 .006	0 .001
	8	1 .017	1 .017	0 .002	0 .003
	7	1 .028	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .038	—	—	—
9	13	5 .017	5 .017	4 .005 –	4 .005 –
	12	4 .022	4 .023	3 .007	2 .001
	11	3 .022	3 .022	2 .006	1 .001
	10	2 .017	2 .017	1 .004	1 .004
	9	2 .040	1 .010 +	0 .001	0 .001
	8	1 .025 –	1 .025 –	0 .004	0 .004
	7	0 .010 +	0 .010 +	—	—
	6	0 .023	0 .023	—	—
	5	0 .049	—	—	—
8	13	5 .042	4 .012	3 .002	3 .003
	12	4 .047	3 .014	2 .003	2 .003
	11	3 .041	2 .011	1 .002	1 .002
	10	2 .029	1 .007	1 .007	0 .001
	9	1 .017	1 .017	0 .002	0 .002
	8	1 .037	0 .006	0 .006	—
	7	0 .015 –	0 .015 –	—	—
	6	0 .032	—	—	—
7	13	3 .031	3 .007	3 .007	2 .001
	12	3 .031	2 .007	2 .007	1 .001
$n_1=13$ $n_2=7$	11	2 .022	2 .022	1 .004	1 .004
	10	1 .012	1 .012	0 .002	0 .002
	9	1 .029	0 .004	0 .004	0 .004
	8	0 .010 +	0 .010 +	—	—
	7	0 .022	0 .022	—	—
	6	0 .044	—	—	—
6	13	3 .021	3 .021	2 .004	2 .004
	12	2 .017	2 .017	1 .003	1 .003
	11	2 .046	1 .010 –	1 .010 –	0 .001
	10	1 .024	1 .024	0 .003	0 .003
	9	1 .050 –	0 .008	0 .008	—
	8	0 .017	0 .017	—	—
	7	0 .034	—	—	—
5	13	2 .012	2 .012	1 .002	1 .002
	12	2 .044	1 .008	1 .008	0 .001
	11	1 .022	1 .022	0 .002	0 .022
	10	1 .047	0 .007	0 .007	—
	9	0 .015 –	0 .015 –	—	—
	8	0 .029	—	—	—
4	13	2 .044	1 .006	1 .006	0 .000
	12	1 .022	1 .022	0 .002	0 .002
	11	0 .006	0 .006	0 .006	—
	10	0 .015 –	0 .015 –	—	—
	9	0 .029	—	—	—
3	13	1 .025	1 .025	0 .002	0 .002
	12	0 .007	0 .007	0 .007	—
	11	0 .018	0 .018	—	—
	10	0 .036	—	—	—
2	13	0 .010 –	0 .010 –	0 .010 –	—
	12	0 .029	—	—	—
$n_1=14$ $n_2=14$	14	10 .049	9 .020	8 .006	7 .003
	13	8 .038	7 .016	6 .006	5 .002
	12	6 .023	6 .023	5 .009	4 .003
	11	5 .027	4 .011	3 .004	3 .004
	10	4 .028	3 .011	2 .003	2 .003
	9	3 .027	2 .009	2 .009	1 .002
	8	2 .023	2 .023	1 .006	0 .001
	7	1 .016	1 .016	0 .003	0 .002
	6	1 .038	0 .008	0 .008	—
	5	0 .020	0 .020	—	—
	4	0 .049	—	—	—
13	14	9 .041	8 .016	7 .006	6 .002
	13	7 .029	6 .011	5 .004	5 .004
	12	6 .037	5 .015 +	4 .005 +	3 .002
	11	5 .041	4 .017	3 .006	2 .001
	10	4 .041	3 .016	2 .005 –	2 .005 –
	9	3 .038	2 .013	1 .003	1 .003
	8	2 .031	1 .009	1 .009	0 .001

TABLES

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=14$ $n_2=18$	7	1 .021	1 .021	0 .004	0 .004
	6	1 .048	0 .010 +	—	—
	5	0 .025 –	0 .025 –	—	—
12	14	8 .033	7 .012	6 .004	6 .004
	18	6 .021	6 .021	5 .007	4 .002
	12	5 .025 +	4 .009	4 .009	3 .003
	11	4 .026	3 .009	3 .009	2 .002
	10	3 .024	3 .024	2 .007	1 .002
	9	2 .019	2 .019	1 .005 –	1 .005 –
	8	2 .042	1 .012	0 .002	0 .002
	7	1 .026	0 .005 +	0 .005 +	—
	6	0 .013	0 .013	—	—
	5	0 .030	—	—	—
11	14	7 .026	6 .009	6 .009	5 .003
	13	6 .039	5 .014	4 .004	4 .004
	12	5 .043	4 .016	3 .005 –	3 .005 –
	11	4 .042	3 .015 –	2 .004	2 .004
	10	3 .036	2 .011	1 .003	1 .003
	9	2 .027	1 .007	1 .007	0 .001
	8	1 .017	1 .017	0 .003	0 .003
	7	1 .038	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .036	—	—	—
10	14	6 .020	6 .020	5 .006	4 .002
	13	5 .028	4 .009	4 .009	3 .002
	12	4 .028	3 .009	3 .009	2 .002
	11	3 .024	3 .024	2 .007	1 .001
	10	2 .018	2 .016	1 .004	1 .004
	9	2 .040	1 .011	0 .002	0 .002
	8	1 .024	1 .024	0 .004	0 .004
	7	0 .010 –	0 .010 –	0 .010 –	—
	6	0 .022	0 .022	—	—
	5	0 .047	—	—	—
9	14	6 .047	5 .014	4 .004	4 .004
	13	4 .018	4 .018	3 .005 –	3 .005 –
	12	3 .017	3 .017	2 .004	2 .004
	11	3 .042	2 .012	1 .002	1 .002
	10	2 .029	1 .007	1 .007	0 .001
	9	1 .017	1 .017	0 .002	0 .002
	8	1 .036	0 .006	0 .006	—
	7	0 .014	0 .014	—	—
	6	0 .030	—	—	—
8	14	5 .036	4 .010 –	4 .010 –	3 .002
	18	4 .039	3 .011	2 .002	2 .002
	12	3 .032	2 .006	2 .006	1 .001
	11	2 .022	2 .022	1 .005 –	1 .005 –
	10	2 .046	1 .012	0 .002	0 .002
	9	1 .026	0 .004	0 .004	0 .004
	8	0 .009	0 .009	0 .009	—
	7	0 .020	0 .020	—	—
	6	0 .040	—	—	—
$n_1=14$ $n_2=7$	14	4 .026	3 .006	3 .006	2 .001
	18	3 .025	2 .006	2 .006	1 .001
	12	2 .017	2 .017	1 .003	1 .003
	11	2 .041	1 .009	1 .009	0 .001
	10	1 .021	1 .021	0 .003	0 .003
	9	1 .043	0 .007	0 .007	—
	8	0 .015 –	0 .015 –	—	—
	7	0 .030	—	—	—
6	14	3 .018	3 .018	2 .003	2 .003
	13	2 .014	2 .014	1 .002	1 .002
	12	2 .037	1 .007	1 .007	0 .001
	11	1 .018	1 .018	0 .002	0 .002
	10	1 .038	0 .005 +	0 .005 +	—
	9	0 .012	0 .012	—	—
	8	0 .024	0 .024	—	—
	7	0 .044	—	—	—
5	14	2 .010 +	2 .010 +	1 .001	1 .001
	13	2 .037	1 .006	1 .006	0 .001
	12	1 .017	1 .017	0 .002	0 .002
	11	1 .038	0 .005 –	0 .005 –	0 .005 –
	10	0 .011	0 .011	—	—
	9	0 .022	0 .022	—	—
	8	0 .040	—	—	—
4	14	2 .039	1 .005 –	1 .005 –	1 .005 –
	13	1 .019	1 .019	0 .002	0 .002
	12	1 .044	0 .005 –	0 .005 –	0 .005 –
	11	0 .011	0 .011	—	—
	10	0 .023	0 .023	—	—
	9	0 .041	—	—	—
3	14	1 .022	1 .022	0 .001	0 .001
	13	0 .006	0 .006	0 .006	—
	12	0 .015 –	0 .015 –	—	—
	11	0 .029	—	—	—
2	14	0 .008	0 .008	0 .008	—
	18	0 .025	0 .025	—	—
	12	0 .050	—	—	—
$n_1=15$ $n_2=15$	15	11 .050 –	10 .021	9 .008	8 .003
	14	9 .040	8 .018	7 .007	6 .003
	13	7 .025 +	6 .010 +	5 .004	5 .004
	12	6 .030	5 .013	4 .005 –	4 .005 –
	11	5 .033	4 .013	3 .005 –	3 .005 –
	10	4 .033	3 .013	2 .004	2 .004
	9	3 .030	2 .010 +	1 .003	1 .003
	8	2 .025 +	1 .007	1 .007	0 .001
	7	1 .018	1 .018	0 .003	0 .003
	6	1 .040	0 .008	0 .008	—
	5	0 .021	0 .021	—	—
	4	0 .050 –	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

			Significance Level			
		a_1	0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=15$	$n_2=14$	15	10 .043	9 .017	8 .006	7 .002
		14	8 .031	7 .013	6 .005 –	6 .005 –
		13	7 .041	6 .017	5 .007	4 .002
		12	6 .046	5 .020	4 .007	3 .002
		11	5 .048	4 .020	3 .007	2 .002
		10	4 .046	3 .018	2 .005	1 .001
		9	3 .041	2 .014	1 .004	1 .004
		8	2 .033	1 .009	1 .009	0 .001
		7	1 .022	1 .022	0 .004	0 .004
		6	1 .049	0 .011	—	—
		5	0 .025 +	—	—	—
	13	15	9 .035 –	8 .013	7 .005 –	7 .005 –
		14	7 .023	7 .023	6 .009	5 .003
		13	6 .039	5 .011	4 .004	4 .004
		12	5 .031	4 .013	3 .004	3 .004
		11	4 .030	3 .011	2 .003	2 .003
		10	3 .026	2 .008	2 .008	1 .002
		9	2 .020	2 .020	1 .005 +	0 .001
		8	2 .043	1 .013	0 .002	0 .002
		7	1 .039	0 .005 +	0 .005 +	—
		6	0 .013	0 .013	—	—
		5	0 .031	—	—	—
	12	15	8 .028	7 .010 –	7 .010 –	6 .003
		14	7 .043	6 .016	5 .006	4 .002
		13	6 .049	5 .019	4 .007	3 .002
		12	5 .049	4 .019	3 .006	2 .002
		11	4 .046 +	3 .017	2 .005 –	2 .005 –
		10	3 .038	2 .013	1 .003	1 .003
		9	2 .028	1 .007	1 .007	0 .001
		8	1 .018	1 .018	0 .003	0 .003
		7	1 .038	0 .007	0 .007	—
		6	0 .017	0 .017	—	—
		5	0 .037	—	—	—
	11	15	7 .022	7 .022	6 .007	5 .002
		14	6 .032	5 .011	4 .003	4 .003
		13	5 .024	4 .012	3 .003	3 .003
		12	4 .032	3 .010 +	2 .003	2 .003
		11	3 .026	2 .008	2 .008	1 .002
		10	2 .019	2 .019	1 .004	1 .004
		9	2 .040	1 .011	0 .002	0 .002
		8	1 .024	1 .024	0 .004	0 .004
		7	1 .049	0 .010 –	0 .010 –	—
		6	0 .022	0 .022	—	—
		5	0 .046	—	—	—
	10	15	6 .017	6 .017	5 .005 –	5 .005 –
		14	5 .023	5 .023	4 .007	3 .002
		13	4 .022	4 .022	3 .007	2 .001
		12	3 .018	3 .018	2 .005 –	2 .005 –
		11	3 .042	2 .013	1 .003	1 .003
		10	2 .029	1 .007	1 .007	0 .001
		9	1 .016	1 .016	0 .002	0 .002
		8	1 .034	0 .006	0 .006	—
		7	0 .013	0 .013	—	—
		6	0 .028	—	—	—
	9	15	6 .042	5 .012	4 .003	4 .003
		14	5 .047	4 .015 –	3 .004	3 .004

			Significance Level			
		a_1	0.05 (0.10)	0.025 (9.05)	0.01 (0.02)	0.005 (0.01)
$n_1=15$	$n_2=9$	13	4 .042	3 .013	2 .003	2 .003
		12	3 .032	2 .009	2 .009	1 .002
		11	2 .021	2 .021	1 .005 –	1 .005 –
		10	2 .045 –	1 .011	0 .002	0 .002
		9	1 .024	1 .024	0 .004	0 .004
		8	1 .048	0 .009	0 .009	—
		7	0 .019	0 .019	—	—
		6	0 .037	—	—	—
	8	15	5 .032	4 .008	4 .008	3 .002
		14	4 .033	3 .009	3 .009	2 .002
		13	3 .025	2 .006	2 .006	1 .001
		12	2 .017	2 .017	1 .003	1 .003
		11	2 .037	1 .008	1 .008	0 .001
		10	1 .019	1 .019	0 .003	0 .003
		9	1 .038	0 .006	0 .005	—
		8	0 .013	0 .013	—	—
		7	0 .025	—	—	—
		6	0 .050 –	—	—	—
	7	15	4 .023	4 .023	3 .005 –	3 .005 –
		14	3 .021	3 .021	2 .004	2 .004
		13	2 .014	2 .014	1 .002	1 .002
		12	2 .032	1 .007	1 .007	0 .001
		11	1 .015 +	1 .016 +	0 .002	0 .002
		10	1 .032	0 .005 –	0 .005 –	0 .005 –
		9	0 .010 +	0 .010 +	—	—
		8	0 .020	0 .020	—	—
		7	0 .038	—	—	—
	6	15	3 .015 +	3 .015 +	2 .003	2 .003
		14	2 .011	2 .011	1 .002	1 .002
		13	2 .031	1 .006	1 .006	0 .001
		12	1 .014	1 .014	0 .002	0 .002
		11	1 .029	0 .004	0 .004	0 .004
		10	0 .009	0 .009	0 .009	—
		9	0 .017	0 .017	—	—
		8	0 .033	—	—	—
	5	15	2 .009	2 .009	2 .009	1 .001
		14	2 .022	1 .005 –	1 .005 –	1 .005 –
		13	1 .014	1 .014	0 .001	0 .001
		12	1 .031	0 .004	0 .004	0 .004
		11	0 .008	0 .008	0 .008	—
		10	0 .016	0 .016	—	—
		9	0 .030	—	—	—
	4	15	2 .035 +	1 .004	1 .004	1 .004
		14	1 .016	1 .016	0 .001	0 .001
		13	1 .037	0 .004	0 .004	0 .004
		12	0 .009	0 .009	0 .009	—
		11	0 .018	0 .018	—	—
		10	0 .033	—	—	—
	3	15	1 .020	1 .020	0 .001	0 .001
		14	0 .005 –	0 .005 –	0 .005 –	0 .005 –
		13	0 .012	0 .012	—	—
		12	0 .025 –	0 .025 –	—	—
		11	0 .043	—	—	—
	2	15	0 .007	0 .007	0 .007	—
		14	0 .022	0 .022	—	—
		13	0 .044	—	—	—

TABLES

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=16$ $n_2=16$	16	11 .022	11 .022	10 .009	9 .003
	15	10 .041	9 .019	8 .008	7 .003
	14	8 .027	7 .012	6 .006 –	6 .006 –
	13	7 .033	6 .016 –	5 .008	4 .002
	12	6 .037	5 .016	4 .006	3 .002
	11	5 .038	4 .016	3 .005	2 .002
	10	4 .037	3 .015 –	2 .005 –	2 .005 –
	9	3 .033	2 .012	1 .003	1 .003
	8	2 .027	1 .008	1 .008	0 .001
	7	1 .019	1 .019	0 .003	0 .003
	6	1 .041	0 .009	0 .009	—
	5	0 .022	0 .022	—	—
15	16	11 .043	10 .018	9 .007	8 .002
	15	9 .033	8 .014	7 .006 +	6 .002
	14	8 .044	7 .019	6 .008	5 .003
	13	6 .022	6 .023	5 .009	4 .003
	12	5 .024	5 .024	4 .009	3 .003
	11	4 .022	4 .022	3 .008	2 .002
	10	4 .049	3 .020	2 .006	1 .001
	9	3 .043	2 .016	1 .004	1 .004
	8	2 .036 –	1 .010 +	0 .002	0 .002
	7	1 .023	1 .023	0 .004	0 .004
	6	0 .011	0 .011	—	—
	5	0 .026	—	—	—
14	16	10 .037	9 .014	8 .006 +	7 .002
	15	8 .028 +	7 .010 –	7 .010 –	6 .003
	14	7 .032	6 .012	5 .005 –	5 .005 –
	13	6 .035 +	5 .014	4 .006 +	3 .001
	12	5 .035 +	4 .014	3 .005 –	3 .005 –
	11	4 .033	3 .012	2 .004	2 .004
	10	3 .028	2 .009	2 .009	1 .002
	9	2 .021	2 .021	1 .005	0 .001
	8	2 .046 –	1 .012	0 .002	0 .002
	7	1 .030	0 .006	0 .006	—
	6	0 .013	0 .012	—	—
	5	0 .031	—	—	—
13	16	9 .030	8 .011	7 .004	7 .004
	15	8 .047	7 .019	6 .007	5 .002
	14	6 .022	6 .022	5 .008	4 .003
	13	5 .022	5 .022	4 .008	3 .003
	12	4 .022	4 .022	3 .007	2 .002
	11	4 .043	3 .018	2 .006 +	1 .001
	10	3 .039	2 .013	1 .003	1 .003
	9	2 .029	1 .003	1 .008	0 .001
	8	1 .013	1 .013	0 .003	0 .002
	7	1 .038	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .037	—	—	—

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=16$ $n_2=12$	16	8 .024	8 .024	7 .008	6 .002
	15	7 .036	6 .013	5 .004	5 .004
	14	6 .040	5 .016 –	4 .005 –	4 .005 –
	13	5 .039	4 .014	3 .004	3 .004
	12	4 .034	3 .012	2 .003	2 .003
	11	3 .027	2 .008	2 .008	1 .002
	10	2 .019	2 .019	1 .005 –	1 .005 –
	9	2 .040	1 .011	0 .002	0 .002
	8	1 .024	1 .024	0 .004	0 .004
	7	1 .048	0 .010 –	0 .010 –	—
	6	0 .021	0 .021	—	—
	5	0 .044	—	—	—
11	16	7 .019	7 .019	6 .006	5 .002
	15	6 .027	5 .009	5 .009	4 .002
	14	5 .027	4 .009	4 .009	3 .002
	13	4 .024	4 .024	3 .003	2 .002
	12	3 .019	3 .019	2 .005 +	1 .001
	11	3 .041	2 .013	1 .003	1 .003
	10	2 .028	1 .007	1 .007	0 .001
	9	1 .016	1 .016	0 .002	0 .002
	8	1 .033	0 .005	0 .006	—
	7	0 .013	0 .013	—	—
	6	0 .027	—	—	—
10	16	7 .045	6 .014	5 .004	5 .004
	15	5 .018	5 .018	4 .006 +	3 .001
	14	4 .017	4 .017	3 .005 –	3 .005 –
	13	4 .042	3 .014	2 .003	2 .003
	12	3 .032	2 .009	2 .009	1 .002
	11	2 .021	2 .021	1 .005 –	1 .005 –
	10	2 .042	1 .011	0 .002	0 .002
	9	1 .023	1 .023	0 .004	0 .004
	8	1 .046 –	0 .008	0 .008	—
	7	0 .017	0 .017	—	—
	6	0 .035 –	—	—	—
9	16	6 .037	5 .010 –	5 .010 –	4 .002
	15	5 .040	4 .012	3 .003	3 .003
	14	4 .034	3 .010 –	3 .010 –	2 .002
	13	3 .026 +	2 .007	2 .007	1 .001
	12	2 .016	2 .015	1 .003	1 .003
	11	2 .033	1 .008	1 .008	0 .001
	10	1 .017	1 .017	0 .002	0 .002
	9	1 .034	0 .006	0 .006	—
	8	0 .012	0 .012	—	—
	7	0 .024	0 .024	—	—
	6	0 .046 +	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=16$ $n_2=8$	16	5 .038	4 .007	4 .007	3 .001
	15	4 .038	3 .007	3 .007	2 .001
	14	3 .031	3 .031	2 .005 −	2 .005 −
	13	3 .047	2 .013	1 .003	1 .003
	12	2 .028	1 .006	1 .006	0 .001
	11	1 .014	1 .014	0 .003	0 .003
	10	1 .037	0 .004	0 .004	0 .004
	9	0 .009	0 .009	0 .009	—
	8	0 .017	0 .017	—	—
	7	0 .033	—	—	—
7	16	4 .020	4 .020	3 .004	3 .004
	15	3 .017	3 .017	2 .003	2 .003
	14	3 .045 +	2 .011	1 .002	1 .002
	13	2 .026	1 .005 −	1 .005 −	1 .005 −
	12	1 .012	1 .012	0 .001	0 .001
	11	1 .024	1 .024	0 .003	0 .003
	10	1 .045 −	0 .007	0 .007	—
	9	0 .014	0 .014	—	—
	8	0 .026	—	—	—
	7	0 .047	—	—	—
6	16	3 .012	3 .012	2 .003	2 .003
	15	3 .046	2 .009	2 .009	1 .001
	14	2 .025 +	1 .004	1 .004	1 .004
	13	1 .011	1 .011	0 .001	0 .001
	12	1 .023	1 .023	0 .003	0 .003
	11	1 .043	0 .006	0 .006	—
	10	0 .012	0 .012	—	—
	9	0 .023	0 .023	—	—
	8	0 .040	—	—	—
5	16	3 .048	2 .008	2 .008	1 .001
	15	2 .028	1 .004	1 .004	1 .004
	14	1 .011	1 .011	0 .001	0 .001
	13	1 .035 +	0 .003	0 .003	0 .003
	12	1 .047	0 .006	0 .006	—
	11	0 .013	0 .013	—	—
	10	0 .022	0 .022	—	—
	9	0 .039	—	—	—
4	16	2 .032	1 .004	1 .004	1 .004
	15	1 .013	1 .013	0 .001	0 .001
	14	1 .032	0 .003	0 .003	0 .003
	13	0 .007	0 .007	0 .007	—
	12	0 .014	0 .014	—	—
	11	0 .026	—	—	—
	10	0 .042	—	—	—
$n_1=16$ $n_2=3$	16	1 .018	1 .018	0 .001	0 .001
	15	0 .004	0 .004	0 .004	0 .004
	14	0 .010 +	0 .010 +	—	—
	13	0 .021	0 .021	—	—
	12	0 .038	—	—	—
2	16	0 .007	0 .007	0 .007	—
	15	0 .020	0 .020	—	—
	14	0 .039	—	—	—
$n_1=17$ $n_2=17$	17	12 .022	12 .022	11 .009	10 .004
	16	11 .043	10 .020	9 .008	8 .003
	15	9 .029	8 .013	7 .005 +	6 .002
	14	8 .035 +	7 .016	6 .007	5 .002
	13	7 .040	6 .018	5 .007	4 .003
	12	6 .042	5 .019	4 .007	3 .002
	11	5 .043	4 .016	3 .007	2 .002
	10	4 .040	3 .016	2 .005 +	1 .001
	9	3 .035 +	2 .013	1 .003	1 .003
	8	2 .029	1 .008	1 .008	0 .001
	7	1 .020	1 .020	0 .004	0 .004
	6	1 .043	0 .009	0 .009	—
	5	0 .022	0 .022	—	—
16	17	12 .044	11 .018	10 .007	9 .003
	16	10 .035 −	9 .015 −	8 .006	7 .002
	15	9 .046	8 .021	7 .009	6 .002
	14	7 .025 +	6 .011	5 .004	5 .004
	13	6 .037	5 .011	4 .004	4 .004
	12	5 .027	4 .011	3 .004	3 .004
	11	4 .025 +	3 .009	3 .009	2 .003
	10	3 .022	3 .022	2 .007	1 .002
	9	3 .046	2 .017	1 .004	1 .004
	8	2 .036	1 .011	0 .002	0 .002
	7	1 .024	1 .024	0 .005 −	0 .005 −
	6	0 .011	0 .011	—	—
	5	0 .036	—	—	—
15	17	11 .038	10 .015 −	9 .006	8 .003
	16	9 .027	8 .011	7 .004	7 .004
	15	8 .035 +	7 .015 −	6 .006	5 .003
	14	7 .040	6 .017	5 .006	4 .002
	13	6 .041	5 .017	4 .006	3 .003
	12	5 .039	4 .016	3 .005 +	2 .001
	11	4 .035 +	3 .013	2 .004	2 .004
	10	3 .029	2 .010 −	2 .010 −	1 .003
	9	2 .022	2 .022	1 .006	0 .001
	8	2 .046	1 .014	0 .002	0 .002
	7	1 .030	0 .006	0 .006	—
	6	0 .014	0 .014	—	—
	5	0 .031	—	—	—

TABLES

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 17$ $n_2 = 14$	17	10 .032	9 .012	8 .004	8 .004
	16	8 .021	8 .021	7 .008	6 .003
	15	7 .028	6 .010 −	6 .010 −	5 .003
	14	6 .028	5 .011	4 .004	4 004
	13	5 .027	4 .010 −	4 .010 −	3 .003
	12	4 .024	4 .024	3 .008	2 .002
	11	4 .049	3 .019	2 .006	1 .001
	10	3 .040	2 .014	1 .003	1 .003
	9	2 .029	1 .008	1 .008	0 .001
	8	1 .018	1 .018	0 .003	0 .003
	7	1 .038	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .036	—	—	—
13	17	9 .026	8 .009	8 .009	7 .003
	16	8 .040	7 .015 +	6 .005 +	5 .002
	15	7 .045 +	6 .018	5 .006	4 .002
	14	6 045 +	5 018	4 .006	3 .002
	13	5 .042	4 .016	3 .005 +	2 .001
	12	4 .035 +	3 .013	2 .004	2 .004
	11	3 .028	2 .009	2 .009	1 .002
	10	2 .019	2 .019	1 .005 −	1 .005 −
	9	2 .040	1 .011	0 .002	0 .002
	8	1 .024	1 .024	0 .004	0 .004
	7	1 .047	0 .010 −	0 .010 −	—
	6	0 .021	0 .021	—	—
	5	0 .043	—	—	—
12	17	8 .021	8 .021	7 .007	6 .002
	16	7 .030	6 .011	5 .003	5 .003
	15	6 .033	5 .012	4 .004	4 .004
	14	5 .030	4 .011	3 .003	3 .003
	13	4 .026	3 .008	3 .008	2 .002
	12	3 .020	3 .020	2 .006	1 .001
	11	3 .041	2 .013	1 .003	1 .003
	10	2 .026	1 .007	1 .007	0 .001
	9	1 .016	1 .016	0 .002	0 .002
	8	1 .032	0 .006	0 .006	—
	7	0 .012	0 .012	—	—
	6	0 .028	—	—	—
11	17	7 .016	7 .016	6 .005 −	6 .005 −
	16	6 .022	6 .022	5 .007	4 .002
	15	5 .022	5 .022	4 .007	3 .002
	14	4 .019	4 .019	3 .006	2 .001

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 17$ $n_2 = 11$	13	4 .042	3 .014	2 .004	2 .004
	12	3 .031	2 .009	2 .009	1 .002
	11	2 .020	2 .020	1 .005 −	1 .005 −
	10	2 .040	1 .011	0 .001	0 .001
	9	1 .022	1 .022	0 .004	0 .004
	8	1 .042	0 .008	0 .008	—
	7	0 .016	0 .016	—	—
	6	0 .033	—	—	—
10	17	7 .041	6 .012	5 .003	5 .003
	16	6 .047	5 .016 +	4 .004	4 .004
	15	5 .043	4 .014	3 .004	3 .004
	14	4 .034	3 .010 +	2 .002	2 .002
	13	3 .024	3 .024	2 .007	1 .001
	12	3 .049	2 .015 +	1 .003	1 .003
	11	2 .031	1 .007	1 .007	0 .001
	10	1 .016	1 .016	0 .002	0 .002
	9	1 .031	0 .005 +	0 .005 +	—
	8	0 .011	0 .011	—	—
	7	0 .022	0 .022	—	—
	6	0 .042	—	—	—
9	17	6 .032	5 .008	5 .008	4 .002
	16	5 .034	4 .010 −	4 .010 −	3 .002
	15	4 .028	3 .008	3 .008	2 .002
	14	3 .020	3 .020	2 .005 −	2 .005 −
	13	3 .042	2 .012	1 .002	1 .002
	12	2 .025 +	1 .006	1 .006	0 .001
	11	2 .048	1 .012	0 .002	0 .002
	10	1 .024	1 .024	0 .004	0 .004
	9	1 .046 −	0 .008	0 .008	—
	8	0 .016	0 .016	—	—
	7	0 .030	—	—	—
8	17	5 .024	5 .024	4 .008	3 .001
	16	4 .023	4 .023	3 .008	2 .001
	15	3 .017	3 .017	2 .004	2 .004
	14	3 .039	2 .010 −	2 .010 −	1 .002
	13	2 .022	2 .022	1 .004	1 .004
	12	2 .043	1 .010 −	1 .010 −	0 .001
	11	1 .020	1 .020	0 .003	0 .003
	10	1 .038	0 .006	0 .006	—
	9	0 .012	0 .012	—	—
	8	0 .022	0 .022	—	—
	7	0 .040	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

		a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 17$	$n_2 = 7$	17	4 .017	4 .017	3 .003	3 .003
		16	3 .014	3 .014	2 .003	2 .003
		15	3 .038	2 .009	2 .009	1 .001
		14	2 .021	2 .021	1 .004	1 .004
		13	2 .042	1 .009	1 .009	0 .001
		12	1 .018	1 .018	0 .002	0 .002
		11	1 .034	0 .005 −	0 .005 −	0 .005 −
		10	0 .010 −	0 .010 −	0 .010 −	—
		9	0 .019	0 .019	—	—
		8	0 .033	—	—	—
	6	17	3 .011	3 .011	2 .002	2 .002
		16	3 .040	2 .008	2 .006	1 .001
		15	2 .021	2 .021	1 .003	1 .003
		14	2 .045 +	1 .009	1 .009	0 .001
		13	1 .018	1 .018	0 .002	0 .002
		12	1 .035 −	0 .005 −	0 .005 −	0 .005 −
		11	0 .009	0 .009	0 .009	—
		10	0 .017	0 .017	—	—
		9	0 .030	—	—	—
		8	0 .050 −	—	—	—
	5	17	3 .043	2 .006	2 .006	1 .001
		16	2 .024	2 .024	1 .003	1 .003
		15	1 .009	1 .009	1 .009	0 .001
		14	1 .021	1 .021	0 .002	0 .002
		13	1 .039	0 .005 −	0 .005 −	0 .005 −
		12	0 .010 −	0 .010 −	0 .010 −	—
		11	0 .018	0 .018	—	—
		10	0 .030	—	—	—
		9	0 .049	—	—	—
	4	17	2 .029	1 .003	1 .003	1 .003
		16	1 .012	1 .012	0 .001	0 .001
		15	1 .028	0 .003	0 .003	0 .003
		14	0 .006	0 .006	0 .006	—
		13	0 .012	0 .012	—	—
		12	0 .021	0 .021	—	—
		11	0 .035 +	—	—	—
	3	17	1 .016	1 .016	0 .001	0 .001
		16	1 .046	0 .004	0 .004	0 .004
		15	0 .009	0 .009	0 .009	—
		14	0 .018	0 .018	—	—
		13	0 .031	—	—	—
		12	0 .049	—	—	—
	2	17	0 .006	0 .006	0 .006	—
		16	0 .018	0 .018	—	—
		15	0 .035 +	—	—	—

		a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 18$	$n_2 = 18$	18	13 .023	13 .023	12 .010 −	11 .004
		17	12 .044	11 .020	10 .009	9 .004
		16	10 .030	9 .014	8 .008	7 .002
		15	9 .038	8 .018	7 .008	6 .003
		14	8 .043	7 .020	6 .009	5 .003
		13	7 .046	6 .022	5 .009	4 .002
		12	6 .047	5 .022	4 .009	3 .003
		11	5 .046	4 .020	3 .008	2 .002
		10	4 .043	3 .015	2 .006	1 .001
		9	3 .033	2 .014	1 .004	1 .004
		8	2 .030	1 .009	1 .009	0 .001
		7	1 .020	1 .020	0 .004	0 .004
		6	1 .044	0 .010 −	0 .010 −	—
		5	0 .023	0 .023	—	—
	17	18	13 .045 +	12 .019	11 .008	10 .003
		17	11 .035	10 .016	9 .007	8 .002
		16	10 .049	9 .022	8 .010 −	7 .004
		15	8 .028	7 .012	6 .005 −	6 .005 −
		14	7 .030	6 .013	5 .005 +	4 .002
		13	6 .031	5 .013	4 .005 −	4 .005 −
		12	5 .030	4 .012	3 .004	3 .004
		11	4 .028	3 .010 +	2 .003	2 .003
		10	3 .023	3 .023	2 .008	1 .002
		9	3 .047	2 .018	1 .005 −	1 .005 −
		8	2 .037	1 .011	0 .002	0 .002
		7	1 .025 −	1 .025 −	0 .005 −	0 .005 −
		6	0 .011	0 .011	—	—
		5	0 .026	—	—	—
	16	18	12 .039	11 .016	10 .006	9 .002
		17	10 .029	9 .012	8 .005 −	8 .005 −
		16	9 .038	8 .017	7 .007	6 .002
		15	8 .043	7 .019	6 .008	5 .003
		14	7 .046	6 .020	5 .008	4 .003
		13	6 .045 +	5 .020	4 .007	3 .002
		12	5 .042	4 .018	3 .006	2 .002
		11	4 .037	3 .015 −	2 .004	2 .004
		10	3 .031	2 .011	1 .003	1 .003
		9	2 .023	2 .023	1 .006	0 .001
		8	2 .046	1 .014	0 .002	0 .002
		7	1 .030	0 .006	0 .006	—
		6	0 .014	0 .014	—	—
		5	0 .031	—	—	—
	15	18	11 .033	10 .013	9 .005 −	9 .005 −
		17	9 .023	9 .023	8 .009	7 .003
		16	8 .029	7 .012	6 .004	6 .004
		15	7 .031	6 .013	5 .005 −	5 .005 −
		14	6 .031	5 .013	4 .004	4 .004
		13	5 .029	4 .011	3 .004	3 .004

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 18$ $n_2 = 15$	12	4 .025 +	3 .009	3 .009	2 .003
	11	3 .020	3 .020	2 .006	1 .001
	10	3 .041	2 .014	1 .004	1 .004
	9	2 .030	1 .008	1 .008	0 .001
	8	1 .018	1 .018	0 .003	0 .003
	7	1 .038	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .036	—	—	—
14	18	10 .028	9 .010 −	9 .010 −	8 .003
	17	9 .043	8 .017	7 .006	6 .002
	16	8 .050 −	7 .021	6 .008	5 .003
	15	6 .022	6 .022	5 .008	4 .003
	14	6 .049	5 .020	4 .007	3 .002
	13	5 .044	4 .017	3 .006	2 .001
	12	4 .037	3 .013	2 .004	2 .004
	11	3 .028	2 .009	2 .009	1 .002
	10	2 .020	2 .020	1 .005 −	1 .005 −
	9	2 .039	1 .011	0 .002	0 .002
	8	1 .024	1 .024	0 .004	0 .004
	7	1 .047	0 .009	0 .009	—
	6	0 .020	0 .020	—	—
	5	0 .043	—	—	—
13	18	9 .025	9 .025	8 .008	7 .002
	17	8 .034	7 .012	6 .004	6 .004
	16	7 .037	6 .014	5 .005 −	5 .005 −
	15	6 .038	5 .014	4 .004	4 .004
	14	5 .032	4 .012	3 .004	3 .004
	13	4 .027	3 .009	3 .009	2 .002
	12	3 .020	3 .020	2 .006	1 .001
	11	3 .040	2 .013	1 .003	1 .003
	10	2 .027	1 .007	1 .007	0 .001
	9	1 .015 +	1 .015 +	0 .002	0 .002
	8	1 .031	0 .006	0 .006	—
	7	0 .012	0 .012	—	—
	6	0 .025 +	—	—	—
12	18	8 .018	8 .018	7 .006	6 .002
	17	7 .026	6 .009	6 .009	5 .003
	16	6 .027	5 .009	5 .009	4 .003
	15	5 .024	5 .024	4 .006	3 .002
	14	4 .020	4 .020	3 .006	2 .001
	13	4 .042	3 .014	2 .004	2 .004
	12	3 .030	2 .009	2 .009	1 .002
	11	2 .019	2 .019	1 .005 −	1 .005 −
$n_1 = 18$ $n_2 = 12$	10	2 .038	1 .010 +	0 .001	0 .001
	9	1 .021	1 .021	0 .003	0 .003
	8	1 .040	0 .007	0 .007	—
	7	0 .016	0 .016	—	—
	6	0 .031	—	—	—
11	18	8 .045 +	7 .014	6 .004	6 .004
	17	6 .018	6 .018	5 .006	4 .001
	16	5 .018	5 .018	4 .005 +	3 .001
	15	5 .043	4 .015 −	3 .004	3 .004
	14	4 .033	3 .011	2 .003	2 .003
	13	3 .023	3 .023	2 .007	1 .001
	12	3 .046	2 .014	1 .003	1 .003
	11	2 .029	1 .007	1 .007	0 .001
	10	1 .015 −	1 .015 −	0 .002	0 .002
	9	1 .029	0 .005 −	0 .005 −	0 .005 −
	8	0 .010 +	0 .010 +	—	—
	7	0 .020	0 .020	—	—
	6	0 .039	—	—	—
10	18	7 .037	6 .010 +	5 .003	5 .003
	17	6 .041	5 .013	4 .003	4 .003
	16	5 .036	4 .011	3 .003	3 .003
	15	4 .028	3 .008	3 .008	2 .002
	14	3 .019	3 .019	2 .005 −	2 .005 −
	13	3 .039	2 .011	1 .002	1 .002
	12	2 .023	2 .023	1 .005 +	0 .001
	11	2 .043	1 .011	0 .001	0 .001
	10	1 .022	1 .022	0 .003	0 .003
	9	1 .040	0 .007	0 .007	—
	8	0 .014	0 .014	—	—
	7	0 .027	—	—	—
	6	0 .049	—	—	—
9	18	6 .029	5 .007	5 .007	4 .002
	17	5 .030	4 .008	4 .008	3 .002
	16	4 .023	4 .023	3 .006	2 .001
	15	3 .016	3 .016	2 .004	2 .004
	14	3 .034	2 .009	2 .009	1 .002
	13	2 .019	2 .019	1 .004	1 .004
	12	2 .037	1 .009	1 .009	0 .001
	11	1 .018	1 .018	0 .003	0 .003
	10	1 .033	0 .005 +	0 .005 +	—
	9	0 .010 +	0 .010 +	—	—
	8	0 .020	0 .020	—	—
	7	0 .038	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 18$ $n_2 = 8$	18	5 .022	5 .022	4 .005 −	4 .005 −
	17	4 .020	4 .020	3 .004	3 .004
	16	3 .014	3 .014	2 .003	2 .003
	15	3 .032	2 .008	2 .008	1 .001
	14	2 .017	2 .017	1 .003	1 .003
	13	2 .034	1 .007	1 .007	0 .001
	12	1 .015 +	1 .015 +	0 .002	0 .002
	11	1 .028	0 .004	0 .004	0 .004
	10	1 .049	0 .008	0 .008	—
	9	0 .016	0 .015	—	—
	8	0 .028	—	—	—
	7	0 .048	—	—	—
7	18	4 .015 +	4 .018 +	3 .003	3 .003
	17	3 .012	3 .012	2 .002	2 .002
	16	3 .032	2 .007	2 .007	1 .001
	15	2 .017	2 .017	1 .003	1 .003
	14	2 .034	1 .007	1 .007	0 .001
	13	1 .014	1 .014	0 .002	0 .002
	12	1 .027	0 .004	0 .004	0 .004
	11	1 .046	0 .007	0 .007	—
	10	0 .013	0 .013	—	—
	9	0 .024	0 .024	—	—
	8	0 .040	—	—	—
6	18	3 .010 −	3 .010 −	3 .010 −	2 .001
	17	3 .035 +	2 .006	2 .006	1 .001
	16	2 .018	2 .018	1 .003	1 .003
	15	2 .028	1 .007	1 .007	0 .001
	14	1 .015 −	1 .015 −	0 .002	0 .002
	13	1 .028	0 .003	0 .003	0 .003
	12	1 .048	0 .007	0 .007	—
	11	0 .013	0 .013	—	—
	10	0 .022	0 .022	—	—
	9	0 .037	—	—	—
5	18	3 .040	2 .006	2 .006	1 .001
	17	2 .021	2 .021	1 .003	1 .003
	16	2 .048	1 .008	1 .008	0 .001
	15	1 .017	1 .017	0 .002	0 .002
	14	1 .033	0 .004	0 .004	0 .004
	13	0 .007	0 .007	0 .007	—
	12	0 .014	0 .014	—	—
	11	0 .024	0 .024	—	—
	10	0 .038	—	—	—
4	18	2 .026	1 .003	1 .003	1 .003
	17	1 .010 −	1 .010 −	1 .010 −	0 .001
	16	1 .024	1 .024	0 .002	0 .002
	15	1 .046	0 .005 −	0 .005 −	0 .005 −
	14	0 .010 −	0 .010 −	0 .010 −	—

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 18$ $n_2 = 4$	13	0 .017	0 .017	—	—
	12	0 .029	—	—	—
	11	0 .046 +	—	—	—
3	18	1 .014	1 .014	0 .001	0 .001
	17	1 .041	0 .003	0 .003	0 .003
	16	0 .008	0 .008	0 .008	—
	15	0 .015 +	0 .018 +	—	—
	14	0 .028	—	—	—
	13	0 .042	—	—	—
2	18	0 .005 +	0 .005 +	0 .005 +	—
	17	0 .016	0 .016	—	—
	16	0 .032	—	—	—
$n_1 = 19$ $n_2 = 19$	19	14 .023	14 .023	13 .010 −	12 .004
	18	13 .045 −	12 .021	11 .009	10 .004
	17	11 .031	10 .015 −	9 .006	8 .003
	16	10 .039	9 .019	8 .009	7 .003
	15	9 .046	8 .022	6 .004	6 .004
	14	8 .050 −	7 .024	5 .004	5 .004
	13	6 .025 +	5 .011	4 .004	4 .004
	12	5 .024	5 .024	3 .003	3 .003
	11	5 .050 −	4 .022	3 .009	2 .003
	10	4 .046	3 .019	2 .006	1 .002
	9	3 .039	2 .015 −	1 .004	1 .004
	8	2 .031	1 .009	1 .009	0 .002
	7	1 .021	1 .021	0 .004	0 .004
	6	1 .045 −	0 .010 −	0 .010 −	—
	5	0 .022	0 .023	—	—
18	19	14 .046	13 .020	12 .008	11 .003
	18	12 .037	11 .017	10 .007	9 .003
	17	10 .024	10 .024	8 .004	8 .004
	16	9 .030	8 .014	7 .006	6 .002
	15	8 .033	7 .015 +	6 .006	5 .002
	14	7 .035 +	6 .016	5 .006	4 .002
	13	6 .035 −	5 .015 +	4 .006	3 .002
	12	5 .023	4 .014	3 .005 −	3 .005 −
	11	4 .030	3 .011	2 .004	2 .004
	10	3 .025 −	3 .025 −	2 .008	1 .002
	9	3 .049	2 .019	1 .005 +	0 .001
	8	2 .038	1 .012	0 .002	0 .002
	7	1 .025 +	0 .005 −	0 .005	0 .005 −
	6	0 .012	0 .012	—	—
	5	0 .027	—	—	—
17	19	13 .040	12 .016	11 .006	10 .002
	18	11 .030	10 .013	9 .005 +	8 .002
	17	10 .040	9 .018	8 .008	7 .003
	16	9 .047	8 .022	7 .009	6 .003

TABLES

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 19$ $n_2 = 17$	15	8 .050 –	7 .033	6 .010 –	5 .004
	14	6 .023	6 .033	5 .010 –	4 .002
	13	6 .049	5 .033	4 .008	3 .002
	12	5 .045 –	4 .019	3 .007	2 .002
	11	4 .039	3 .015 +	2 .005 –	2 .005 –
	10	3 .032	2 .011	1 .003	1 .003
	9	2 .024	2 .024	1 .007	0 .001
	8	2 .047	1 .015 –	0 .002	0 .002
	7	1 .031	0 .006	0 .006	—
	6	0 .014	0 .014	—	—
	5	0 .031	—	—	—
16	19	12 .035 –	11 .013	10 .005 –	10 .005 –
	18	10 .024	10 .024	9 .010 –	8 .004
	17	9 .031	8 .012	7 .005 +	6 .002
	16	8 .025 –	7 .015 +	6 .006	5 .002
	15	7 .036	6 .015 +	5 .006	4 .002
	14	6 .034	5 .014	4 .005 +	3 .002
	13	5 .031	4 .012	3 .004	3 .004
	12	4 .027	3 .010 –	3 .010 –	2 .003
	11	3 .021	3 .021	2 .007	1 .002
	10	3 .043	2 .015 –	1 .004	1 .004
	9	2 .030	1 .009	1 .009	0 .001
	8	1 .018	1 .018	0 .003	0 .003
	7	1 .037	0 .007	0 .007	—
	6	0 .017	0 .017	—	—
	5	0 .036	—	—	—
15	19	11 .029	10 .011	9 .004	9 .004
	18	10 .046	9 .019	8 .007	7 .002
	17	8 .022	8 .022	7 .009	6 .003
	16	7 .025 –	7 .025 –	6 .010 –	5 .002
	15	6 .024	6 .024	5 .009	4 .002
	14	5 .022	5 .022	4 .008	3 .002
	13	5 .045 +	4 .018	3 .006	2 .002
	12	4 .037	3 .014	2 .004	2 .004
	11	3 .029	2 .009	2 .009	1 .002
	10	2 .020	2 .020	1 .005 +	0 .001
	9	2 .039	1 .011	0 .002	0 .002
	8	1 .023	1 .023	0 .004	0 .004
	7	1 .046	0 .009	0 .009	—
	6	0 .020	0 .020	—	—
	5	0 .042	—	—	—
14	19	10 .024	10 .024	9 .008	8 .003
	18	9 .037	8 .014	7 .005 –	7 .005 –
	17	8 .042	7 .017	6 .006	5 .002
	16	7 .042	6 .017	5 .006	4 .002
	15	6 .039	5 .015 +	4 .005 +	3 .001
	14	5 .034	4 .013	3 .004	3 .004
	13	4 .027	3 .009	3 .009	2 .003
	12	3 .020	3 .020	2 .006	1 .001
	11	3 .040	2 .013	1 .003	1 .003
	10	2 .027	1 .007	1 .007	0 .001
	9	1 .015 –	1 .015 –	0 .002	0 .002
	8	1 .030	0 .005 +	0 .005 +	—
	7	0 .012	0 .012	—	—
	6	0 .024	0 .024	—	—
	5	0 .049	—	—	—

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 19$ $n_2 = 18$	19	9 .030	9 .020	8 .006	7 .002
	18	8 .039	7 .010 +	6 .003	6 .003
	17	7 .031	6 .011	5 .004	5 .004
	16	6 .029	5 .011	4 .002	4 .003
	15	5 .025 +	4 .009	4 .009	3 .003
	14	4 .020	4 .020	3 .005	2 .002
	13	4 .041	3 .015 –	2 .004	2 .004
	12	3 .029	2 .009	2 .009	1 .002
	11	2 .019	2 .019	1 .005 –	1 .005 –
	10	2 .035	1 .010 –	1 .010 –	0 .001
	9	1 .020	1 .020	0 .003	0 .003
	8	1 .038	0 .007	0 .007	—
	7	0 .015 –	0 .015 –	—	—
	6	0 .030	—	—	—
12	19	9 .049	8 .016	7 .005 –	7 .005 –
	18	7 .022	7 .022	6 .007	5 .002
	17	6 .022	6 .022	5 .007	4 .002
	16	5 .019	5 .019	4 .006	3 .002
	15	5 .042	4 .015 +	3 .004	3 .004
	14	4 .033	3 .011	2 .003	2 .003
	13	3 .023	3 .023	2 .006	1 .001
	12	3 .043	2 .014	1 .003	1 .003
	11	2 .037	1 .007	1 .007	0 .001
	10	2 .050 –	1 .014	0 .002	0 .002
	9	1 .037	0 .005 –	0 .005 –	0 .005 –
	8	1 .050 –	0 .010 –	0 .010 –	—
	7	0 .019	0 .019	—	—
	6	0 .027	—	—	—
11	19	8 .041	7 .012	6 .003	6 .003
	18	7 .047	6 .016	5 .004	5 .004
	17	6 .043	5 .015 –	4 .004	4 .004
	16	5 .035 +	4 .012	3 .003	3 .003
	15	4 .027	3 .008	3 .008	2 .002
	14	3 .018	3 .018	2 .005 –	2 .005 –
	13	3 .035 +	2 .010 +	1 .002	1 .002
	12	2 .021	2 .021	1 .005 –	1 .005 –
	11	2 .040	1 .010 +	0 .001	0 .001
	10	1 .020	1 .020	0 .003	0 .003
	9	1 .037	0 .006	0 .006	—
	8	0 .013	0 .013	—	—
	7	0 .025 –	0 .025 –	—	—
	6	0 .046	—	—	—
10	19	7 .032	6 .009	6 .009	5 .002
	18	6 .035	5 .011	4 .003	4 .003
	17	5 .030	4 .009	4 .009	3 .003
	16	4 .022	4 .022	3 .006	2 .001
	15	4 .047	3 .015 –	2 .004	2 .004
	14	3 .030	2 .008	2 .008	1 .002
	13	2 .017	2 .017	1 .004	1 .004
	12	2 .033	1 .008	1 .008	0 .001
	11	1 .016	1 .016	0 .002	0 .002
	10	1 .029	0 .005 –	0 .005 –	0 .005 –
	9	0 .009	0 .009	0 .009	—
	8	0 .018	0 .018	—	—
	7	0 .033	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1 = 19$ $n_2 = 9$	19	6 .028	5 .006	5 .006	4 .001
	18	5 .026	4 .007	4 .007	3 .001
	17	4 .020	4 .020	3 .005 −	3 .005 −
	16	4 .044	3 .013	2 .003	2 .003
	15	3 .028	2 .007	2 .007	1 .001
	14	2 .015 −	2 .015 −	1 .003	1 .003
	13	2 .029	1 .006	1 .006	0 .001
	12	1 .013	1 .013	0 .002	0 .002
	11	1 .024	1 .024	0 .004	0 .004
	10	1 .042	0 .007	0 .007	—
	9	0 .013	0 .013	—	—
	8	0 .024	0 .024	—	—
	7	0 .043	—	—	—
8	19	5 .019	5 .019	4 .004	4 .004
	18	4 .017	4 .017	3 .004	3 .004
	17	4 .044	3 .011	2 .002	2 .002
	16	3 .027	2 .005	2 .006	1 .001
	15	2 .014	2 .014	1 .002	1 .002
	14	2 .027	1 .006	1 .006	0 .001
	13	2 .049	1 .011	0 .001	0 .001
	12	1 .021	1 .021	0 .003	0 .003
	11	1 .038	0 .006	0 .006	—
	10	0 .011	0 .011	—	—
	9	0 .020	0 .020	—	—
	8	0 .034	—	—	—
7	19	4 .013	4 .013	3 .002	3 .002
	18	4 .047	3 .010 +	2 .002	2 .002
	17	3 .028	2 .006	2 .006	1 .001
	16	2 .014	2 .014	1 .002	1 .002
	15	2 .028	1 .005 +	1 .005 +	0 .001
	14	1 .011	1 .011	0 .001	0 .001
	13	1 .021	1 .021	0 .003	0 .003
	12	1 .037	0 .005 +	0 .005 +	—
	11	0 .010 −	0 .010 −	0 .010 −	—
	10	0 .017	0 .017	—	—
	9	0 .030	—	—	—
	8	0 .048	—	—	—
6	19	4 .050	3 .009	3 .009	2 .001
	18	3 .031	2 .005 +	2 .005 +	1 .001
	17	2 .015 +	2 .015 +	1 .002	1 .003
	16	2 .032	1 .006	1 .006	0 .000
	15	1 .012	1 .012	0 .001	0 .001
	14	1 .023	1 .023	0 .003	0 .003
	13	1 .039	0 .005 +	0 .005 +	—
	12	0 .010 −	0 .010 −	0 .010 −	—
	11	0 .017	0 .017	—	—
	10	0 .028	—	—	—
	9	0 .045 +	—	—	—
5	19	3 .036	2 .005 −	2 .005 −	2 .005 −
	18	2 .015	2 .018	1 .002	1 .002
	17	2 .042	1 .006	1 .006	0 .000
	16	1 .014	1 .014	0 .001	0 .001
	15	1 .028	0 .003	0 .003	0 .003
	14	1 .047	0 .006	0 .006	—
	13	0 .011	0 .011	—	—
$n_1 = 19$ $n_2 = 5$	12	0 .019	0 .019	—	—
	11	0 .030	—	—	—
	10	0 .047	—	—	—
4	19	2 .024	2 .024	1 .002	1 .002
	18	1 .009	1 .009	1 .009	0 .001
	17	1 .021	1 .021	0 .002	0 .002
	16	1 .040	0 .004	0 .004	0 .004
	15	0 .008	0 .008	0 .008	—
	14	0 .014	0 .014	—	—
	13	0 .024	0 .024	—	—
	12	0 .037	—	—	—
3	19	1 .013	1 .013	0 .001	0 .001
	18	1 .038	0 .003	0 .003	0 .003
	17	0 .006	0 .006	0 .006	—
	16	0 .013	0 .013	—	—
	15	0 .023	0 .023	—	—
	14	0 .036	—	—	—
2	19	0 .005 −	0 .005 −	0 .005 −	0 .005 −
	18	0 .014	0 .014	—	—
	17	0 .029	—	—	—
	16	0 .048	—	—	—
$n_1 = 20$ $n_2 = 20$	20	15 .024	15 .024	13 .004	13 .004
	19	14 .046	13 .022	12 .010 −	11 .004
	18	12 .032	11 .015 +	10 .007	9 .003
	17	11 .041	10 .020	9 .009	8 .004
	16	10 .048	9 .024	7 .005 −	7 .005 −
	15	8 .027	7 .012	6 .005 +	5 .002
	14	7 .028	6 .013	5 .005 +	4 .002
	13	6 .028	5 .012	4 .005 −	4 .005 −
	12	5 .027	4 .011	3 .004	3 .004
	11	4 .024	4 .024	3 .009	2 .003
	10	4 .048	3 .020	2 .007	1 .002
	9	3 .041	2 .015 +	1 .004	1 .004
	8	2 .032	1 .010 −	1 .010 −	0 .002
	7	1 .022	1 .022	0 .004	0 .004
	6	1 .046	0 .010 +	—	—
	5	0 .024	0 .024	—	—
19	20	15 .047	14 .020	13 .008	12 .003
	19	13 .039	12 .018	11 .008	10 .003
	18	11 .026	10 .012	9 .005 −	9 .005 −
	17	10 .032	9 .015 −	8 .006	7 .002
	16	9 .036	8 .017	7 .007	6 .003
	15	8 .038	7 .018	6 .008	5 .003
	14	7 .039	6 .018	5 .007	4 .003
	13	6 .038	5 .017	4 .007	3 .002
	12	5 .035 +	4 .015 +	3 .005 +	2 .002
	11	4 .031	3 .012	2 .004	2 .004
	10	3 .026	2 .009	2 .009	1 .002
	9	2 .019	2 .019	1 .005 +	0 .001
	8	2 .039	1 .012	0 .002	0 .002
	7	1 .026	0 .005 +	0 .005 +	—
	6	0 .012	0 .012	—	—
	5	0 .027	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level			
		0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=20$ $n_2=18$	20	14 .041	13 .017	12 .007	11 .003
	19	12 .032	11 .014	10 .006	9 .002
	18	11 .043	10 .020	9 .008	8 .003
	17	10 .050 −	9 .034	7 .004	7 .004
	16	8 .026	7 .011	6 .005 −	6 .005 −
	15	7 .027	6 .012	5 .004	5 .004
	14	6 .026	5 .011	4 .004	4 .004
	13	5 .024	5 .024	4 .009	3 .003
	12	5 .047	4 .020	3 .007	2 .002
	11	4 .041	3 .016	2 .005 +	1 .001
	10	3 .033	2 .012	1 .003	1 .003
	9	2 .024	2 .024	1 .007	0 .001
	8	2 .048	1 .015 −	0 .003	0 .003
	7	1 .031	0 .006	0 .006	—
	6	0 .014	0 .014	—	—
	5	0 .031	—	—	—
17	20	13 .036	12 .014	11 .005 +	10 .002
	19	11 .026	10 .011	9 .004	9 .004
	18	10 .034	9 .015 −	8 .006	7 .002
	17	9 .038	8 .017	7 .007	6 .003
	16	8 .040	7 .018	6 .007	5 .003
	15	7 .039	6 .017	5 .007	4 .002
	14	6 .037	5 .016	4 .006	3 .002
	13	5 .033	4 .013	3 .005 −	3 .005 −
	12	4 .028	3 .010 +	2 .003	2 .003
	11	3 .022	3 .022	2 .007	1 .002
	10	3 .042	2 .015 +	1 .004	1 .004
	9	2 .031	1 .009	1 .009	0 .001
	8	1 .019	1 .019	0 .002	0 .003
	7	1 .037	0 .008	0 .008	—
	6	0 .017	0 .017	—	—
	5	0 .036	—	—	—
16	20	12 .031	11 .012	10 .004	10 .004
	19	11 .049	10 .021	9 .008	8 .003
	18	9 .026	8 .011	7 .004	7 .004
	17	8 .028	7 .012	6 .004	6 .004
	16	7 .028	6 .012	5 .004	5 .004
	15	6 .026	5 .011	4 .004	4 .004
	14	5 .023	5 .023	4 .009	3 .003
	13	5 .046	4 .019	3 .007	2 .002
	12	4 .038	3 .014	2 .004	2 .004
	11	3 .029	2 .010 −	2 .010 −	1 .002
	10	2 .020	2 .020	1 .005 +	0 .001
	9	2 .039	1 .011	0 .002	0 .002
	8	1 .023	1 .023	0 .004	0 .004
	7	1 .045 +	0 .009	0 .009	—
	6	0 .020	0 .020	—	—
	5	0 .041	—	—	—
15	20	11 .026	10 .009	10 .009	9 .003
	19	10 .040	9 .016	8 .006	7 .002
	18	9 .046	8 .019	7 .007	6 .002
	17	8 .047	7 .020	6 .008	5 .003
	16	7 .045 −	6 .019	5 .007	4 .002
	15	6 .040	5 .017	4 .006	3 .002
	14	5 .034	4 .013	3 .004	3 .004

	a_1	Significance Level			
		0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=20$ $n_2=15$	13	4 .028	3 .010 −	3 .010 −	2 .003
	12	3 .020	3 .020	2 .006	1 .001
	11	3 .039	2 .013	1 .003	1 .003
	10	2 .026	1 .007	1 .007	0 .001
	9	2 .049	1 .015 −	0 .002	0 .002
	8	1 .039	0 .005 +	0 .005 +	—
	7	0 .012	0 .012	—	—
	6	0 .024	0 .024	—	—
	5	0 .046	—	—	—
14	20	10 .022	10 .022	9 .007	8 .002
	19	9 .032	8 .012	7 .004	7 .004
	18	8 .035 +	7 .014	6 .005 −	6 .005 −
	17	7 .035 −	6 .013	5 .005 −	5 .005 −
	16	6 .031	5 .012	4 .004	4 .004
	15	5 .026	4 .009	4 .009	3 .003
	14	4 .020	4 .020	3 .007	2 .002
	13	4 .040	3 .015 −	2 .004	2 .004
	12	3 .029	2 .009	2 .009	1 .002
	11	2 .018	2 .018	1 .005 −	1 .005 −
	10	2 .035 +	1 .010 −	1 .010 −	0 .001
	9	1 .019	1 .019	0 .003	0 .003
	8	1 .037	0 .007	0 .007	—
	7	0 .014	0 .014	—	—
	6	0 .029	—	—	—
18	20	9 .017	9 .017	8 .005 +	7 .002
	19	8 .035 −	8 .035 −	7 .008	6 .003
	18	7 .026	6 .009	6 .009	5 .003
	17	6 .024	6 .024	5 .008	4 .002
	16	5 .020	5 .020	4 .007	3 .002
	15	5 .041	4 .015 +	3 .005 −	3 .005 −
	14	4 .031	3 .011	2 .003	2 .003
	13	3 .022	3 .022	2 .006	1 .001
	12	3 .041	2 .013	1 .003	1 .003
	11	2 .026	1 .007	1 .007	0 .001
	10	2 .047	1 .013	0 .002	0 .002
	9	1 .026	0 .004	0 .004	0 .004
	8	1 .047	0 .009	0 .009	—
	7	0 .018	0 .018	—	—
	6	0 .035 −	—	—	—
12	20	9 .044	8 .014	7 .004	7 .004
	19	7 .018	7 .018	6 .006	5 .002
	18	6 .018	6 .018	5 .006	4 .002
	17	6 .043	5 .016	4 .005 −	4 .005 −
	16	5 .034	4 .012	3 .003	3 .003
	15	4 .025 +	3 .006	3 .008	2 .002
	14	4 .049	3 .017	2 .005 −	2 .005 −
	13	3 .033	2 .010 −	2 .010 −	1 .002
	12	2 .020	2 .020	1 .005 −	1 .005 −
	11	2 .036	1 .009	1 .009	0 .001
	10	1 .018	1 .018	0 .003	0 .003
	9	1 .034	0 .006	0 .006	—
	8	0 .012	0 .012	—	—
	7	0 .023	0 .023	—	—
	6	0 .043	—	—	—

TABLE A-29 (Continued). TABLES FOR TESTING SIGNIFICANCE IN 2 × 2 TABLES WITH UNEQUAL SAMPLES

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=20$ $n_2=11$	20	8 .037	7 .010 +	6 .003	6 .003
	19	7 .042	6 .012	5 .004	5 .004
	18	6 .037	5 .012	4 .003	4 .003
	17	5 .029	4 .009	4 .009	3 .002
	16	4 .021	4 .021	3 .008	2 .001
	15	4 .042	3 .014	2 .003	2 .003
	14	3 .028	2 .008	2 .008	1 .001
	13	2 .016	2 .016	1 .003	1 .002
	12	2 .029	1 .007	1 .007	0 .001
	11	1 .014	1 .014	0 .002	0 .002
	10	1 .026	0 .004	0 .004	0 .004
	9	1 .046	0 .008	0 .008	—
	8	0 .016	0 .016	—	—
	7	0 .029	—	—	—
10	20	7 .030	6 .008	6 .008	5 .002
	19	6 .031	5 .009	5 .009	4 .002
	18	5 .026	4 .007	4 .007	3 .002
	17	4 .018	4 .018	3 .005 –	3 .008 –
	16	4 .039	3 .012	2 .003	2 .003
	15	3 .024	3 .024	2 .006	1 .001
	14	3 .046 +	2 .013	1 .003	1 .003
	13	2 .025 +	1 .006	1 .006	0 .001
	12	2 .046 –	1 .011	0 .001	0 .001
	11	1 .021	1 .021	0 .003	0 .003
	10	1 .027	0 .006	0 .006	—
	9	0 .012	0 .012	—	—
	8	0 .022	0 .022	—	—
	7	0 .028	—	—	—
9	20	6 .023	6 .023	5 .008 +	4 .001
	19	5 .022	5 .022	4 .005 +	3 .001
	18	4 .016	4 .016	3 .004	3 .004
	17	4 .037	3 .010 +	2 .002	2 .002
	16	3 .022	3 .022	2 .008 +	1 .001
	15	3 .043	2 .012	1 .002	1 .002
	14	2 .022	2 .023	1 .005 –	1 .005 –
	13	2 .041	1 .009	1 .009	0 .001
	12	1 .018	1 .018	0 .002	0 .002
	11	1 .032	0 .005 –	0 .005 –	0 .005 –
	10	0 .009	0 .009	0 .009	—
	9	0 .017	0 .017	—	—
	8	0 .029	—	—	—
	7	0 .050 –	—	—	—
8	20	5 .017	5 .017	4 .003	4 .003
	19	4 .015 –	4 .015 –	3 .003	3 .003
	18	4 .038	3 .009	3 .009	2 .002
	17	3 .022	3 .022	2 .005 –	2 .005 –
	16	3 .044	2 .011	1 .002	1 .002
	15	2 .022	2 .022	1 .004	1 .004
	14	2 .040	1 .009	1 .009	0 .001
	13	1 .016	1 .016	0 .002	0 .002
	12	1 .029	0 .004	0 .004	0 .004
	11	1 .048	0 .008	0 .008	—
	10	0 .014	0 .014	—	—
	9	0 .024	0 .024	—	—
	8	0 .041	—	—	—

	a_1	Significance Level 0.05 (0.10)	0.025 (0.05)	0.01 (0.02)	0.005 (0.01)
$n_1=20$ $n_2=7$	20	4 .012	4 .012	3 .002	3 .002
	19	4 .042	3 .009	3 .009	2 .001
	18	3 .024	3 .024	2 .006 –	2 .006 –
	17	3 .050 –	2 .011	1 .002	1 .002
	16	2 .023	2 .023	1 .004	1 .004
	15	2 .043	1 .009	1 .009	0 .001
	14	1 .016	1 .016	0 .002	0 .002
	13	1 .029	0 .004	0 .004	0 .004
	12	1 .048	0 .007	0 .007	—
	11	0 .013	0 .013	—	—
	10	0 .022	0 .022	—	—
	9	0 .036	—	—	—
6	20	4 .048	3 .008	3 .008	2 .001
	19	3 .028	2 .005 –	2 .005 –	2 .005 –
	18	2 .013	2 .013	1 .002	1 .002
	17	2 .028	1 .004	1 .004	1 .004
	16	1 .010 –	1 .010 –	1 .010 –	0 .001
	15	1 .018	1 .018	0 .002	0 .002
	14	1 .032	0 .004	0 .004	0 .004
	13	0 .007	0 .007	0 .007	—
	12	0 .013	0 .013	—	—
	11	0 .022	0 .022	—	—
	10	0 .035 –	—	—	—
5	20	3 .033	2 .004	2 .004	2 .004
	19	2 .016	2 .016	1 .002	1 .002
	18	2 .038	1 .006 +	1 .005 +	0 .000
	17	1 .012	1 .012	0 .001	0 .001
	16	1 .023	1 .022	0 .002	0 .002
	15	1 .040	0 .005 –	0 .005 –	0 .005 –
	14	0 .009	0 .009	0 .009	—
	13	0 .015 –	0 .015 –	—	—
	12	0 .024	0 .024	—	—
	11	0 .038	—	—	—
4	20	2 .022	2 .022	1 .002	1 .002
	19	1 .008	1 .008	1 .008	0 .000
	18	1 .018	1 .016	0 .001	0 .001
	17	1 .035 +	0 .003	0 .003	0 .003
	16	0 .007	0 .007	0 .007	—
	15	0 .012	0 .012	—	—
	14	0 .020	0 .020	—	—
	13	0 .031	—	—	—
	12	0 .047	—	—	—
3	20	1 .012	1 .012	0 .001	0 .001
	19	1 .024	0 .002	0 .002	0 .002
	18	0 .006	0 .006	0 .006	—
	17	0 .011	0 .011	—	—
	16	0 .020	0 .020	—	—
	15	0 .032	—	—	—
	14	0 .047	—	—	—
2	20	0 .004	0 .004	0 .004	0 .004
	19	0 .013	0 .013	—	—
	18	0 .026	—	—	—
	17	0 .043	—	—	—
1	20	0 .048	—	—	—

TABLE A-30. TABLES FOR DISTRIBUTION-FREE TOLERANCE LIMITS (TWO-SIDED)

Values (r, s) such that we may assert with confidence at least γ that 100P percent of a population lies between the r^{th} smallest and the s^{th} largest of a random sample of n from that population (no assumption of normality required)

	$\gamma = 0.75$				$\gamma = 0.90$			
n \ P	.75	.90	.95	.99	.75	.90	.95	.99
50	5,5	2,1	—	—	5,4	1,1	—	—
55	6,6	2,2	1,1	—	5,5	2,1	—	—
60	7,6	2,2	1,1	—	6,5	2,1	—	—
65	7,7	3,2	1,1	—	6,6	2,2	—	—
70	8,7	3,2	1,1	—	7,6	2,2	—	—
75	8,8	3,3	1,1	—	7,7	2,2	—	—
80	9,8	3,3	2,1	—	8,7	3,2	1,1	—
85	10,9	4,3	2,1	—	8,8	3,2	1,1	—
90	10,10	4,3	2,1	—	9,8	3,2	1,1	—
95	11,10	4,3	2,1	—	9,9	3,3	1,1	—
100	11,11	4,4	2,1	—	10,10	3,3	1,1	—
110	12,12	5,4	2,2	—	11,11	4,3	2,1	—
120	14,13	5,5	2,2	—	12,12	4,4	2,1	—
130	15,14	6,5	3,2	—	13,13	5,4	2,1	—
140	16,15	6,6	3,2	—	14,14	5,5	2,2	—
150	17,17	6,6	3,3	—	16,15	5,5	2,2	—
170	20,19	7,7	4,3	—	18,17	6,6	3,2	—
200	23,23	9,8	4,4	—	21,21	8,7	3,3	—
300	35,35	13,13	6,6	1,1	33,32	12,11	5,5	—
400	47,47	18,18	9,8	2,1	45,44	16,16	8,7	1,1
500	59,59	23,22	11,11	2,1	57,56	21,20	10,9	1,1
600	72,71	28,27	13,13	2,2	68,68	26,25	12,11	2,1
700	84,83	33,32	16,15	3,2	80,80	30,30	14,14	2,2
800	96,96	37,37	18,18	3,3	92,92	35,34	16,16	3,2
900	108,108	42,42	21,20	4,3	104,104	40,39	19,18	3,2
1000	121,120	47,47	23,22	4,4	117,116	44,44	21,20	3,3

	$\gamma = 0.95$				$\gamma = 0.99$			
n \ P	.75	.90	.95	.99	.75	.90	.95	.99
50	4,4	1,1	—	—	3,3	—	—	—
55	5,4	1,1	—	—	4,3	—	—	—
60	5,5	1,1	—	—	4,4	—	—	—
65	6,5	2,1	—	—	5,4	1,1	—	—
70	6,6	2,1	—	—	5,5	1,1	—	—
75	7,6	2,1	—	—	5,5	1,1	—	—
80	7,7	2,2	—	—	6,5	1,1	—	—
85	8,7	2,2	—	—	6,6	2,1	—	—
90	8,8	3,2	—	—	7,6	2,1	—	—
95	9,8	3,2	1,1	—	7,7	2,1	—	—
100	9,9	3,2	1,1	—	8,7	2,2	—	—
110	10,10	3,3	1,1	—	9,8	2,2	—	—
120	11,11	4,3	1,1	—	10,9	3,2	—	—
130	13,12	4,4	2,1	—	11,10	3,3	1,1	—
140	14,13	4,4	2,1	—	12,11	3,3	1,1	—
150	15,14	5,4	2,1	—	13,13	4,3	1,1	—
170	17,16	6,5	2,2	—	15,15	5,4	2,1	—
200	20,20	7,6	3,2	—	18,18	6,5	2,2	—
300	32,31	11,11	5,4	—	29,29	10,9	4,3	—
400	43,43	15,15	7,6	—	40,40	14,13	6,5	—
500	55,54	20,19	9,8	1,1	52,51	18,17	7,7	—
600	67,66	24,24	11,10	1,1	63,63	22,22	9,9	—
700	78,78	29,28	13,13	2,1	75,74	26,26	11,11	1,1
800	90,90	33,33	15,15	2,2	86,86	31,30	13,13	1,1
900	102,102	38,37	18,17	2,2	98,97	35,35	15,15	2,1
1000	114,114	43,42	20,19	3,2	110,109	40,39	18,17	2,1

When the values of r and s given in the table are not equal, they are interchangeable; i.e., for $n = 120$ with confidence at least 0.75 we may assert that 75% of the population lies between the 14th smallest and the 13th largest values, or between the 13th smallest and the 14th largest values.

TABLE A-31. TABLES FOR DISTRIBUTION-FREE TOLERANCE LIMITS (ONE-SIDED)

Largest values of m such that we may assert with confidence at least γ that 100P percent of a population lies below the m^{th} largest (or above the m^{th} smallest) of a random sample of n from that population (no assumption of normality required)

	γ = 0.75				γ = 0.90				γ = 0.95				γ = 0.99			
n \ P	.75	.90	.95	.99	.75	.90	.95	.99	.75	.90	.95	.99	.75	.90	.95	.99
50	10	3	1	—	9	2	1	—	8	2	—	—	6	1	—	—
55	12	4	2	—	10	3	1	—	9	2	—	—	7	1	—	—
60	13	4	2	—	11	3	1	—	10	2	1	—	8	1	—	—
65	14	5	2	—	12	4	1	—	11	3	1	—	9	2	—	—
70	15	5	2	—	13	4	1	—	12	3	1	—	10	2	—	—
75	16	6	2	—	14	4	1	—	13	3	1	—	10	2	—	—
80	17	6	3	—	15	5	2	—	14	4	1	—	11	2	—	—
85	19	7	3	—	16	5	2	—	15	4	1	—	12	3	—	—
90	20	7	3	—	17	5	2	—	16	5	1	—	13	3	1	—
95	21	7	3	—	18	6	2	—	17	5	2	—	14	3	1	—
100	22	8	3	—	20	6	2	—	18	5	2	—	15	4	1	—
110	24	9	4	—	22	7	3	—	20	6	2	—	17	4	1	—
120	27	10	4	—	24	8	3	—	22	7	2	—	19	5	1	—
130	29	11	5	—	26	9	3	—	25	8	3	—	21	6	2	—
140	31	12	5	1	28	10	4	—	27	8	3	—	23	6	2	—
150	34	12	6	1	31	10	4	—	29	9	3	—	26	7	2	—
170	39	14	7	1	35	12	5	—	33	11	4	—	30	9	3	—
200	46	17	8	1	42	15	6	—	40	13	5	—	36	11	4	—
300	70	26	12	2	65	23	10	1	63	22	9	1	58	19	7	—
400	94	36	17	3	89	32	15	2	86	30	13	1	80	27	11	—
500	118	45	22	3	113	41	19	2	109	39	17	2	103	35	14	1
600	143	55	26	4	136	51	23	3	133	48	21	2	126	44	18	1
700	167	65	31	5	160	60	28	4	156	57	26	3	149	52	22	2
800	192	74	36	6	184	69	32	5	180	66	30	4	172	61	26	2
900	216	84	41	7	208	79	37	5	204	75	35	4	195	70	30	3
1000	241	94	45	8	233	88	41	6	228	85	39	5	219	79	35	3

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TABLES

TABLE A-32. CONFIDENCE ASSOCIATED WITH A TOLERANCE LIMIT STATEMENT

Confidence γ with which we may assert that 100P percent of the population lies between the largest and smallest of a random sample of n from that population (continuous distribution assumed)

n	$P = .75$	$P = .90$	$P = .95$	$P = .99$
3	.16	.03	.01	.00
4	.26	.05	.01	.00
5	.37	.08	.02	.00
6	.47	.11	.03	.00
7	.56	.15	.04	.00
8	.63	.19	.06	.00
9	.70	.23	.07	.00
10	.76	.26	.09	.00
11	.80	.30	.10	.01
12	.84	.34	.12	.01
13	.87	.38	.14	.01
14	.90	.42	.15	.01
15	.92	.45	.17	.01
16	.94	.49	.19	.01
17	.95	.52	.21	.01
18	.96	.55	.23	.01
19	.97	.58	.25	.02
20	.98	.61	.26	.02
25	.99	.73	.36	.03
30	1.00–	.82	.45	.04
40	—	.92	.60	.06
50	—	.97	.72	.09
60	—	.99	.81	.12
70	—	.99	.87	.16
80	—	1.00–	.91	.19
90	—	—	.94	.23
100	—	—	.96	.26

Adapted with permission from *Annals of Mathematical Statistics*, Vol. 29, No. 2, June 1958, pp. 599-601, from article entitled "Tables for Obtaining Non-Parametric Tolerance Limits" by Paul N. Somerville.

TABLE A-33. CRITICAL VALUES OF r FOR THE SIGN TEST

	α for Two-Sided Test					α for Two-Sided Test			
	.01	.05	.10	.25		.01	.05	.10	.25
	α for One-Sided Test					α for One-Sided Test			
n	.005	.025	.05	.125	n	.005	.025	.05	.125
1	—	—	—	—	46	13	15	16	18
2	—	—	—	—	47	14	16	17	19
3	—	—	—	0	48	14	16	17	19
4	—	—	—	0	49	15	17	18	19
5	—	—	0	0	50	15	17	18	20
6	—	0	0	1	51	15	18	19	20
7	—	0	0	1	52	16	18	19	21
8	0	0	1	1	53	16	18	20	21
9	0	1	1	2	54	17	19	20	22
10	0	1	1	2	55	17	19	20	22
11	0	1	2	3	56	17	20	21	23
12	1	2	2	3	57	18	20	21	23
13	1	2	3	3	58	18	21	22	24
14	1	2	3	4	59	19	21	22	24
15	2	3	3	4	60	19	21	23	25
16	2	3	4	5	61	20	22	23	25
17	2	4	4	5	62	20	22	24	25
18	3	4	5	6	63	20	23	24	26
19	3	4	5	6	64	21	23	24	26
20	3	5	5	6	65	21	24	25	27
21	4	5	6	7	66	22	24	25	27
22	4	5	6	7	67	22	25	26	28
23	4	6	7	8	68	22	25	26	28
24	5	6	7	8	69	23	25	27	29
25	5	7	7	9	70	23	26	27	29
26	6	7	8	9	71	24	26	28	30
27	6	7	8	10	72	24	27	28	30
28	6	8	9	10	73	25	27	28	31
29	7	8	9	10	74	25	28	29	31
30	7	9	10	11	75	25	28	29	32
31	7	9	10	11	76	26	28	30	32
32	8	9	10	12	77	26	29	30	32
33	8	10	11	12	78	27	29	31	33
34	9	10	11	13	79	27	30	31	33
35	9	11	12	13	80	28	30	32	34
36	9	11	12	14	81	28	31	32	34
37	10	12	13	14	82	28	31	33	35
38	10	12	13	14	83	29	32	33	35
39	11	12	13	15	84	29	32	33	36
40	11	13	14	15	85	30	32	34	36
41	11	13	14	16	86	30	33	34	37
42	12	14	15	16	87	31	33	35	37
43	12	14	15	17	88	31	34	35	38
44	13	15	16	17	89	31	34	36	38
45	13	15	16	18	90	32	35	36	39

For values of n larger than 90, approximate values of r may be found by taking the nearest integer less than $(n-1)/2 - k\sqrt{n+1}$, where k is 1.2879, 0.9800, 0.8224, 0.5752 for the 1, 5, 10, 25% values, respectively.

TABLE A-34. CRITICAL VALUES OF $T_\alpha(n)$ FOR THE WILCOXON SIGNED-RANKS TEST

T_α is the integer such that the probability that $T \leq T_\alpha$ is closest to α. For example, for $n = 8$, $\Pr\{T \leq 3\} = .020$ and $\Pr\{T \leq 4\} = .027$; hence we list $T_{.025}(8) = 4$.

n	α for One-Sided Test		
	.025	.01	.005
	α for Two-Sided Test		
	.05	.02	.01
6	0	—	—
7	2	0	—
8	4	2	0
9	6	3	2
10	8	5	3
11	11	7	5
12	14	10	7
13	17	13	10
14	21	16	13
15	25	20	16
16	30	24	20
17	35	28	23
18	40	33	28
19	46	38	32
20	52	43	38
21	59	49	43
22	66	56	49
23	73	62	55
24	81	69	61
25	89	77	68

For large n,

$$T_P(n) = \frac{n(n+1)}{4} - z_{1-P}\sqrt{\frac{n(n+1)(2n+1)}{24}} \text{ approximately}$$

where z is given in Table A-2.

Adapted with permission from *Some Rapid Approximate Statistical Procedures* by F. Wilcoxon, 1949, American Cyanamid Company.

TABLE A-35. CRITICAL VALUES OF SMALLER RANK SUM FOR THE WILCOXON-MANN-WHITNEY TEST

n_2	α for 2-Sided Test	α for 1-Sided Test	n_1 (Smaller Sample) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3	.20	.10		3	7																	
	.10	.05			6																	
	.05	.025																				
	.01	.005																				
4	.20	.10		3	7	13																
	.10	.05			6	11																
	.05	.025				10																
	.01	.005																				
5	.20	.10		4	8	14	20															
	.10	.05		3	7	12	19															
	.05	.025			6	11	17															
	.01	.005					15															
6	.20	.10		4	9	15	22	30														
	.10	.05		3	8	13	20	28														
	.05	.025			7	12	18	26														
	.01	.005				10	16	23														
7	.20	.10		4	10	16	23	32	41													
	.10	.05		3	8	14	21	29	39													
	.05	.025			7	13	20	27	36													
	.01	.005				10	16	24	32													
8	.20	.10		5	11	17	25	34	44	55												
	.10	.05		4	9	15	23	31	41	51												
	.05	.025		3	8	14	21	29	38	49												
	.01	.005				11	17	25	34	43												
9	.20	.10	1	5	11	19	27	36	46	58	70											
	.10	.05		4	9	16	24	33	43	54	66											
	.05	.025		3	8	14	22	31	40	51	62											
	.01	.005			6	11	18	26	35	45	56											
10	.20	.10	1	6	12	20	28	38	49	60	73	87										
	.10	.05		4	10	17	26	35	45	56	69	82										
	.05	.025		3	9	15	23	32	42	53	65	78										
	.01	.005			6	12	19	27	37	47	58	71										
11	.20	.10	1	6	13	21	30	40	51	63	76	91	106									
	.10	.05		4	11	18	27	37	47	59	72	86	100									
	.05	.025		3	9	16	24	34	44	55	68	81	96									
	.01	.005			6	12	20	28	38	49	61	73	87									
12	.20	.10	1	7	14	22	32	42	54	66	80	94	110	127								
	.10	.05		5	11	19	28	38	49	62	75	89	104	120								
	.05	.025		4	10	17	26	35	46	58	71	84	99	115								
	.01	.005			7	13	21	30	40	51	63	76	90	105								

13	.20	.10	1	7	15	23	33	44	56	69	83	98	114	131	149							
	.10	.05		5	12	20	30	40	52	64	78	92	108	125	142							
	.05	.025		4	10	18	27	37	48	60	73	88	103	119	136							
	.01	.005			7	14	22	31	41	53	65	79	93	109	125							
14	.20	.10	1	7	16	25	35	46	59	72	86	102	118	136	154	174						
	.10	.05		5	13	21	31	42	54	67	81	96	112	129	147	166						
	.05	.025		4	11	19	28	38	50	62	76	91	106	123	141	160						
	.01	.005			7	14	22	32	43	54	67	81	96	112	129	147						
15	.20	.10	1	8	16	26	37	48	61	75	90	106	123	141	159	179	200					
	.10	.05		6	13	22	33	44	56	69	84	99	116	133	152	171	192					
	.05	.025		4	11	20	29	40	52	65	79	94	110	127	145	164	184					
	.01	.005			8	15	23	33	44	56	69	84	99	115	133	151	171					
16	.20	.10	1	8	17	27	38	50	64	78	93	109	127	145	165	185	206	229				
	.10	.05		6	14	24	34	46	58	72	87	103	120	138	156	176	197	219				
	.05	.025		4	12	21	30	42	54	67	82	97	113	131	150	169	190	211				
	.01	.005			8	15	24	34	46	58	72	86	102	119	136	155	175	196				
17	.20	.10	1	9	18	28	40	52	66	81	97	113	131	150	170	190	212	235	259			
	.10	.05		6	15	25	35	47	61	75	90	106	123	142	161	182	203	225	249			
	.05	.025		5	12	21	32	43	56	70	84	100	117	135	154	174	195	217	240			
	.01	.005			8	16	25	36	47	60	74	89	105	122	140	159	180	201	223			
18	.20	.10	1	9	19	30	42	55	69	84	100	117	135	155	175	196	218	242	266	291		
	.10	.05		7	15	26	37	49	63	77	93	110	127	146	166	187	208	231	255	280		
	.05	.025		5	13	22	33	45	58	72	87	103	121	139	158	179	200	222	246	270		
	.01	.005			8	16	26	37	49	62	76	92	108	125	144	163	184	206	228	252		
19	.20	.10	2	10	20	31	43	57	71	87	103	121	139	159	180	202	224	248	273	299	325	
	.10	.05	1	7	16	27	38	51	65	80	96	113	131	150	171	192	214	237	262	287	313	
	.05	.025		5	13	23	34	46	60	74	90	107	124	143	163	182	205	228	252	277	303	
	.01	.005		3	9	17	27	38	50	64	78	94	111	129	147	168	189	210	234	258	283	
20	.20	.10	2	10	21	32	45	59	74	90	107	125	144	164	185	207	230	255	280	306	333	361
	.10	.05	1	7	17	28	40	53	67	83	99	117	135	155	175	197	220	248	268	294	320	348
	.05	.025		5	14	24	35	48	62	77	93	110	128	147	167	188	210	234	258	283	309	337
	.01	.005		3	9	18	28	39	52	66	81	97	114	132	151	172	193	215	239	263	289	315

For larger values of n_1 and n_2, critical values are given to a good approximation by the formula:

$$\frac{n_1}{2}(n_1 + n_2 + 1) - z\left\{\frac{n_1 n_2(n_1 + n_2 + 1)}{12}\right\}^{1/2}$$

where $z = 1.28$ for $\alpha = .20$ (two-sided test)
$z = 1.64$ for $\alpha = .10$ ”
$z = 1.96$ for $\alpha = .05$ ”
$z = 2.58$ for $\alpha = .01$ ”

TABLE A-36. SHORT TABLE OF RANDOM NUMBERS

46	96	85	77	27	92	86	26	45	21	89	91	71	42	64	64	58	22	75	81	74	91	48	46	18
44	19	15	32	63	55	87	77	33	29	45	00	31	34	84	05	72	90	44	27	78	22	07	62	17
34	39	80	62	24	33	81	67	28	11	34	79	26	35	34	23	09	94	00	80	55	31	63	27	91
74	97	80	30	65	07	71	30	01	84	47	45	89	70	74	13	04	90	51	27	61	34	63	87	44
22	14	61	60	86	38	33	71	13	38	72	08	16	13	50	56	48	51	29	48	30	93	45	66	29
40	03	96	40	03	47	24	60	09	21	21	18	00	05	86	52	85	40	73	73	57	68	36	33	91
52	33	76	44	56	15	47	75	78	73	78	19	87	06	98	47	48	02	62	03	42	05	32	55	02
87	59	20	40	93	17	82	24	19	90	80	87	32	74	59	84	24	49	79	17	23	75	83	42	00
11	02	55	67	48	84	74	36	22	67	19	20	15	92	58	37	13	75	54	89	56	73	23	39	07
10	33	79	26	34	54	71	38	89	74	68	48	23	17	49	18	81	05	52	85	70	05	73	11	17
67	59	28	25	47	89	11	65	65	20	42	23	96	41	64	20	30	89	87	64	37	93	36	96	35
98	50	75	20	09	18	54	34	68	02	54	87	23	05	43	36	98	29	97	93	87	08	30	92	98
24	43	23	72	80	64	34	27	23	46	15	36	10	63	21	59	69	76	02	62	31	62	47	60	34
39	91	63	18	38	27	10	78	88	84	42	32	00	97	92	00	04	94	50	05	75	82	70	80	35
74	62	19	67	54	18	28	92	33	69	98	96	74	35	72	11	68	25	08	95	31	79	11	79	54
91	03	35	60	81	16	61	97	25	14	78	21	22	05	25	47	26	37	80	39	19	06	41	02	00
42	57	66	76	72	91	03	63	48	46	44	01	33	53	62	28	80	59	55	05	02	16	13	17	54
06	36	63	06	15	03	72	38	01	58	25	37	66	48	56	19	56	41	29	28	76	49	74	39	50
92	70	96	70	89	80	87	14	25	49	25	94	62	78	26	15	41	39	48	75	64	69	61	06	38
91	08	88	53	52	13	04	82	23	00	26	36	47	44	04	08	84	80	07	44	76	51	52	41	59
68	85	97	74	47	53	90	05	90	84	87	48	25	01	11	05	45	11	43	15	60	40	31	84	59
59	54	13	09	13	80	42	29	63	03	24	64	12	43	28	10	01	65	62	07	79	83	05	59	61
39	18	32	69	33	46	58	19	34	03	59	28	97	31	02	65	47	47	70	39	74	17	30	22	65
67	43	31	09	12	60	19	57	63	78	11	80	10	97	15	70	04	89	81	78	54	84	87	83	42
61	75	37	19	56	90	75	39	03	56	49	92	72	95	27	52	87	47	12	52	54	62	43	23	13
78	10	91	11	00	63	19	63	74	58	69	03	51	38	60	36	53	56	77	06	69	03	89	91	24
93	23	71	58	09	78	08	03	07	71	79	32	25	19	61	04	40	33	12	06	78	91	97	88	95
37	55	48	82	63	89	92	59	14	72	19	17	22	51	90	20	03	64	96	60	48	01	95	44	84
62	13	11	71	17	23	29	25	13	85	33	35	07	69	25	68	57	92	57	11	84	44	01	33	66
29	89	97	47	03	13	20	86	22	45	59	98	64	53	89	64	94	81	55	87	73	81	58	46	42
16	94	85	82	89	07	17	30	29	89	89	80	98	36	25	36	53	02	49	14	34	03	52	09	20
04	93	10	59	75	12	98	84	60	93	68	16	87	60	11	50	46	56	58	45	88	72	50	46	11
95	71	43	68	97	18	85	17	18	08	00	50	77	50	46	92	45	26	97	21	48	22	23	08	32
86	05	39	14	35	48	68	18	36	57	09	62	40	28	87	08	74	79	91	08	27	12	43	32	03
59	30	60	10	41	31	00	69	63	77	01	89	94	60	19	02	70	88	72	33	38	88	20	60	86
05	45	35	40	54	03	98	96	76	27	77	84	80	08	64	60	44	34	54	24	85	20	85	77	32
71	85	17	74	66	27	85	19	55	56	51	36	48	92	32	44	40	47	10	38	22	52	42	29	96
80	20	32	80	98	00	40	92	57	51	52	83	14	55	31	99	73	23	40	07	64	54	44	99	21
13	50	78	02	73	39	66	82	01	28	67	51	75	66	33	97	47	58	42	44	88	09	28	58	06
67	92	65	41	45	36	77	96	46	21	14	39	56	36	70	15	74	43	62	69	82	30	77	28	77
72	56	73	44	26	04	62	81	15	35	79	26	99	57	28	22	25	94	80	62	95	48	98	23	86
28	86	85	64	94	11	58	78	45	36	34	45	91	38	51	10	68	36	87	81	16	77	30	19	36
69	57	40	80	44	94	60	82	94	93	98	01	48	50	57	69	60	77	69	60	74	22	05	77	17
71	20	03	30	79	25	74	17	78	34	54	45	04	77	42	59	75	78	64	99	37	03	18	03	36
89	98	55	98	22	45	12	49	82	71	57	33	28	69	50	59	15	09	25	79	39	42	84	18	70
58	74	82	81	14	02	01	05	77	94	65	57	70	39	42	48	56	84	31	59	18	70	41	74	60
50	54	73	81	91	07	81	26	25	45	49	61	22	88	41	20	00	15	59	93	51	60	65	65	63
49	33	72	90	10	20	65	28	44	63	95	86	75	78	69	24	41	65	86	10	34	10	32	00	93
11	85	01	43	65	02	85	69	56	88	34	29	64	35	48	15	70	11	77	83	01	34	82	91	04
34	22	46	41	84	74	27	02	57	77	47	93	72	02	95	63	75	74	69	69	61	34	31	92	13

TABLE A-36 (Continued). SHORT TABLE OF RANDOM NUMBERS

05	57	23	06	26	23	08	66	16	11	75	28	81	56	14	62	82	45	65	80	36	02	76	55	63
37	78	16	06	57	12	46	22	90	97	78	67	39	06	63	60	51	02	07	16	75	12	90	41	16
23	71	15	08	82	64	87	29	01	20	46	72	05	80	19	27	47	15	76	51	58	67	06	80	54
42	67	98	41	67	44	28	71	45	08	19	47	76	30	26	72	33	69	92	51	95	23	26	85	76
05	83	03	84	32	62	83	27	48	83	09	19	84	90	20	20	50	87	74	93	51	62	10	23	30
60	46	18	41	23	74	73	51	72	90	40	52	95	41	20	89	48	98	27	38	81	33	83	82	94
32	80	64	75	91	98	09	40	64	89	29	99	46	35	69	91	50	73	75	92	90	56	82	93	24
79	86	53	77	78	06	62	37	48	82	71	00	78	21	65	65	88	45	82	44	78	93	22	78	09
45	13	23	32	01	09	46	36	43	66	37	15	35	04	88	79	83	53	19	13	91	59	81	81	87
20	60	97	48	21	41	84	22	72	77	99	81	83	30	46	15	90	26	51	73	66	34	99	40	60
67	91	44	83	43	25	56	33	28	80	99	53	27	56	19	80	76	32	53	95	07	53	09	61	98
86	50	76	93	86	35	68	45	37	83	47	44	92	57	66	59	64	16	48	39	26	94	54	66	40
66	73	38	38	23	36	10	95	16	01	10	01	59	71	55	99	24	88	31	41	00	73	13	80	62
55	11	50	29	17	73	97	04	20	39	20	22	71	11	43	00	15	10	12	35	09	11	00	89	05
23	54	33	87	92	92	04	49	73	96	57	53	57	08	93	09	69	87	83	07	46	39	50	37	85
41	43	67	79	44	57	40	29	10	34	58	63	51	18	07	41	02	39	79	14	40	68	10	01	61
03	97	71	72	43	27	36	24	59	88	82	87	26	31	11	44	28	58	99	47	83	21	35	22	88
90	24	83	48	07	41	56	68	11	14	77	75	48	68	08	90	89	63	87	00	06	18	63	21	91
98	98	97	42	27	11	80	51	13	13	03	42	91	14	51	22	15	48	67	52	09	40	34	60	85
74	20	94	21	49	96	51	69	99	85	43	76	55	81	36	11	88	68	32	43	08	14	78	05	34
94	67	48	87	11	84	00	85	93	56	43	99	21	74	84	13	56	41	90	96	30	04	19	68	73
58	18	84	82	71	23	66	33	19	25	65	17	90	84	24	91	75	36	14	83	86	22	70	86	89
31	47	28	24	88	49	28	69	78	62	23	45	53	38	78	65	87	44	91	93	91	62	76	09	20
45	82	31	06	70	92	73	27	83	57	15	64	40	57	56	54	42	35	40	93	55	82	08	78	87
81	49	87	12	27	41	07	91	72	64	63	42	06	66	82	71	28	36	45	31	99	01	03	35	76
69	37	22	23	46	10	75	83	62	94	44	65	46	23	65	71	69	20	89	12	16	56	61	70	41
93	67	21	56	98	42	52	53	14	86	24	70	25	18	23	23	56	24	03	86	11	06	46	10	23
77	56	18	87	01	32	20	18	70	79	20	85	77	89	28	17	77	15	52	47	15	30	35	12	75
87	07	47	79	60	75	24	15	31	63	25	93	27	66	19	53	52	49	98	45	12	12	06	00	32
72	08	71	01	73	46	39	60	37	58	22	25	20	84	30	02	03	62	68	58	38	04	06	89	94
55	22	48	46	72	50	14	24	47	67	84	37	32	84	82	64	97	13	69	86	20	09	80	46	75
69	24	98	90	70	29	34	25	33	23	12	69	90	50	38	93	84	32	28	96	03	65	70	90	12
01	86	77	18	21	91	66	11	84	65	48	75	26	94	51	40	51	53	36	39	77	69	06	25	07
51	40	94	06	80	61	34	28	46	28	11	48	48	94	60	65	06	63	71	06	19	35	05	32	56
58	78	02	85	80	29	67	27	44	07	67	23	20	28	22	62	97	59	62	13	41	72	70	71	07
33	75	88	51	00	33	56	15	84	34	28	50	16	65	12	81	56	43	54	14	63	37	74	97	59
58	60	37	45	62	09	95	93	16	59	35	22	91	78	04	97	98	80	20	04	38	93	13	92	30
72	13	12	95	32	87	99	32	83	65	40	17	92	57	22	68	98	79	16	23	58	56	56	07	47
22	21	13	16	10	52	57	71	40	49	95	25	55	36	95	57	25	25	77	05	38	05	62	57	77
97	94	83	67	90	68	74	88	17	22	38	01	04	33	49	38	47	57	61	87	15	39	43	87	00
09	03	68	53	63	29	27	31	66	53	39	34	88	87	04	35	80	69	52	74	99	16	52	01	65
29	95	61	42	65	05	72	27	28	18	09	85	24	59	46	08	91	55	38	62	51	71	47	37	38
81	96	78	90	47	41	38	36	33	95	05	90	26	72	85	23	23	30	70	51	56	93	23	84	80
44	62	20	81	21	57	57	85	00	47	26	10	87	22	45	72	03	51	75	23	38	38	56	77	97
68	91	12	16	08	02	18	74	56	79	21	53	63	41	77	15	07	39	87	11	19	25	62	19	30
29	38	77	60	29	09	25	09	42	28	07	15	40	67	56	29	58	75	84	06	19	54	31	16	53
54	13	39	19	29	64	97	73	71	61	78	03	24	02	93	86	69	76	74	28	08	98	84	08	28
75	16	85	64	64	93	85	68	08	84	15	41	57	84	45	11	70	13	17	60	47	80	10	13	00
36	47	17	08	79	03	92	85	18	42	95	48	27	37	99	98	81	94	44	72	06	95	42	31	17
29	61	08	21	91	23	76	72	84	98	26	23	66	54	86	88	95	14	82	57	17	99	16	28	99

TABLE A-36 (Continued). SHORT TABLE OF RANDOM NUMBERS

08	46	88	56	84	81	20	89	68	52	45	41	01	71	55	14	18	05	18	01	74	94	50	66	07
74	12	14	57	26	12	48	88	67	04	88	69	05	27	23	68	84	23	52	07	21	67	13	52	01
08	23	73	51	23	92	98	05	54	32	84	46	61	33	92	18	30	91	73	11	30	44	21	71	20
99	21	30	24	79	30	18	06	96	20	62	06	47	96	07	04	82	93	01	56	62	70	43	22	85
96	82	59	39	23	22	20	95	72	00	24	85	63	57	75	88	05	79	13	75	78	64	25	89	85
62	16	18	23	64	50	90	57	50	54	04	96	09	08	17	14	63	17	80	80	56	10	17	11	57
21	40	82	41	45	41	41	89	46	18	55	86	94	32	57	44	12	64	75	12	78	01	13	69	81
13	88	48	82	60	78	96	30	57	13	40	28	10	24	48	73	50	92	70	18	72	86	54	09	76
29	65	33	98	92	99	26	01	86	11	85	42	48	86	59	24	96	35	07	87	67	31	25	89	62
17	49	05	12	18	53	01	98	80	17	83	35	38	14	79	82	83	56	44	51	35	40	70	68	22
14	36	47	29	16	14	22	27	62	93	15	60	43	13	05	25	75	40	08	85	44	70	89	64	13
78	09	76	61	07	48	31	27	48	28	96	11	26	95	03	06	86	81	52	72	66	74	71	60	25
83	17	94	26	39	01	48	68	56	97	05	76	82	89	15	66	81	63	81	96	12	44	71	57	43
87	12	89	46	85	58	09	94	39	92	09	08	76	54	88	82	78	24	94	39	02	79	07	58	27
44	30	30	40	85	96	84	99	87	03	93	03	00	74	18	67	13	97	11	12	59	30	54	51	66
54	56	85	50	81	32	42	53	60	36	98	03	65	10	60	26	52	64	74	35	28	13	24	65	23
65	99	30	88	88	44	91	22	50	72	61	95	90	98	80	65	03	45	04	27	88	70	88	40	49
55	56	01	94	09	94	02	71	85	10	27	20	51	27	86	09	15	11	62	41	03	22	82	10	60
55	78	63	40	57	16	20	17	73	02	76	09	62	95	85	67	75	45	99	63	59	55	88	27	99
83	78	98	57	23	38	95	61	06	58	69	07	35	82	10	35	61	61	66	06	75	45	83	33	70
20	14	56	25	85	78	33	37	34	15	50	63	78	74	56	49	84	72	58	00	93	68	11	47	46
48	04	07	78	13	43	03	62	46	20	06	94	09	27	69	00	71	51	43	84	21	12	86	03	51
61	10	14	89	57	87	76	60	77	02	06	50	15	60	46	22	27	52	87	43	69	58	65	79	02
64	91	36	96	42	22	57	18	13	44	46	81	95	15	37	91	81	63	33	38	39	50	47	45	94
89	53	11	10	88	10	46	41	63	84	20	46	86	41	05	82	95	56	76	23	03	13	94	28	49
96	45	86	42	40	85	95	17	28	74	65	20	70	90	34	33	61	11	01	31	37	28	81	00	31
84	11	25	39	49	31	80	86	53	51	35	48	22	28	25	27	06	38	71	90	50	77	40	41	58
29	75	56	28	89	23	26	12	23	48	89	28	34	08	52	21	05	73	08	04	83	42	91	01	91
68	92	40	82	19	49	20	85	32	69	34	17	99	11	56	39	15	67	55	53	65	29	15	51	32
94	19	67	99	27	70	71	04	43	18	44	18	75	11	70	53	21	60	78	30	92	54	21	02	42
86	84	68	46	85	58	91	23	65	24	71	19	67	18	79	90	83	47	86	32	48	69	97	10	87
63	22	84	85	10	02	05	08	47	93	45	70	25	27	90	32	98	41	45	96	39	86	91	78	79
42	58	20	46	19	11	16	98	21	93	14	91	74	92	31	97	68	24	20	85	19	54	75	37	84
87	90	76	51	58	49	25	58	28	69	55	55	73	10	22	66	79	23	80	03	51	11	00	81	37
20	12	97	40	25	45	94	35	18	65	10	99	31	24	42	14	53	78	41	79	36	57	79	19	76
24	11	65	19	92	46	11	76	64	37	33	23	96	23	73	93	99	53	14	49	40	01	63	17	74
98	21	62	16	29	73	52	06	26	35	30	52	74	61	20	57	45	86	36	54	75	29	64	49	43
02	82	14	07	19	72	77	97	39	77	25	32	60	39	04	04	88	65	47	20	81	72	40	65	48
97	20	87	54	01	93	38	53	07	38	61	00	22	95	65	79	69	28	90	49	24	61	78	19	40
17	86	31	34	32	29	40	23	66	71	14	91	93	75	02	10	13	86	27	32	59	36	40	06	61
75	50	70	16	34	21	99	87	09	37	27	40	66	07	73	13	44	06	10	43	91	11	73	13	97
47	53	77	58	88	52	47	37	21	60	83	58	21	59	82	88	05	35	17	66	33	62	15	09	88
20	93	99	76	58	93	00	39	77	75	59	39	49	61	13	68	11	80	07	72	81	65	95	94	53
91	02	65	18	16	57	93	64	76	45	21	49	51	58	96	12	62	42	10	79	57	44	97	35	66
58	49	25	97	76	12	90	94	85	25	36	40	97	46	71	83	36	55	41	38	49	98	82	70	96
98	51	20	13	77	75	86	22	62	68	36	87	02	47	99	68	80	27	34	10	09	22	84	59	33
06	32	54	17	31	87	20	77	78	80	98	42	48	42	47	41	76	11	41	79	41	48	26	94	59
40	96	49	91	79	57	18	61	50	48	06	07	68	43	07	01	04	06	22	03	11	11	75	95	02
58	48	98	93	53	01	61	75	76	90	25	97	08	76	69	35	65	24	83	85	00	49	37	05	46
76	98	86	43	60	47	85	65	73	62	66	15	98	17	20	43	96	27	87	53	57	37	92	86	46

TABLE A-36 (Continued). SHORT TABLE OF RANDOM NUMBERS

24	81	06	14	98	24	93	58	63	66	58	26	24	45	65	91	42	68	67	42	61	74	77	93	46
75	55	54	29	67	02	81	01	67	54	08	81	34	00	79	62	38	52	14	88	88	66	59	41	97
49	71	80	54	37	73	34	11	74	14	91	86	82	41	02	76	12	36	71	38	43	72	84	36	27
04	19	48	85	54	98	00	41	47	44	63	13	27	50	18	75	16	72	40	90	02	45	87	82	15
03	15	52	42	22	91	22	96	38	41	03	27	15	67	26	36	81	75	11	82	94	33	62	08	94
10	80	17	67	83	05	31	23	08	07	40	00	60	44	65	70	16	31	73	05	46	41	47	64	68
40	42	27	55	76	82	88	42	76	51	58	49	58	75	38	23	57	06	64	69	46	90	09	55	68
95	57	21	21	25	12	05	41	70	28	03	59	97	37	64	48	69	48	59	60	89	76	85	83	05
57	27	64	94	98	88	93	70	86	59	46	84	08	32	81	75	61	19	49	11	28	46	76	79	28
80	56	69	49	63	83	78	78	76	36	89	51	16	47	35	86	69	96	69	88	91	22	47	24	84
44	51	75	51	08	17	43	53	31	09	60	34	34	61	93	66	01	94	37	13	24	09	75	29	21
55	42	48	76	50	13	89	69	00	05	99	45	82	01	53	86	68	81	86	50	75	20	17	94	47
80	50	67	83	01	97	76	21	64	34	62	43	02	84	38	13	60	26	32	86	81	48	17	56	41
03	64	65	44	02	75	41	33	91	28	82	97	57	38	49	27	26	97	84	44	26	12	00	68	24
14	53	75	37	91	43	95	15	13	26	33	27	45	48	33	80	80	26	69	76	04	87	83	58	82
01	64	43	36	30	71	24	75	92	73	07	81	13	35	46	88	62	80	64	69	86	25	73	92	98
39	38	79	42	17	77	99	55	32	85	13	35	48	49	80	83	59	06	34	94	06	03	61	85	02
74	96	24	94	89	54	66	29	35	88	50	46	65	50	26	62	45	80	61	95	07	99	57	10	54
21	16	54	55	77	46	38	33	88	55	21	56	18	93	32	94	24	80	97	08	78	39	73	87	70
58	51	99	53	96	73	60	77	21	06	76	59	78	55	96	99	07	53	91	95	99	60	56	61	79
46	98	27	95	19	22	29	41	56	76	83	48	49	82	79	79	20	00	26	40	22	50	14	30	73
58	46	36	76	19	18	00	60	50	28	32	44	18	35	99	28	91	50	53	62	21	61	26	46	81
43	05	50	00	20	39	25	46	84	39	27	39	92	42	59	04	64	15	09	35	07	11	25	51	17
84	07	33	83	87	14	33	79	07	66	60	43	66	57	57	57	59	01	78	80	18	77	63	58	10
93	54	23	72	70	09	36	16	24	04	74	05	65	29	64	67	87	28	13	98	01	48	29	75	89
54	46	72	02	34	52	81	38	52	96	14	54	27	32	41	74	84	83	90	01	97	59	87	66	41
43	60	84	28	82	93	91	76	70	81	50	22	09	40	89	64	85	82	76	91	16	71	99	98	70
64	80	80	16	92	46	42	46	47	22	87	16	20	65	82	01	45	21	49	80	17	39	70	74	03
78	70	39	30	06	59	65	14	84	04	82	28	46	64	05	89	81	80	09	89	56	11	27	81	44
14	88	67	03	59	32	15	83	04	01	20	82	92	25	34	88	84	80	76	69	25	10	04	86	02
69	28	06	18	56	78	97	49	14	85	01	58	31	16	20	58	74	03	27	05	80	89	15	67	49
99	68	09	96	36	54	10	77	95	88	90	84	52	16	52	58	87	51	81	71	68	58	11	85	50
01	66	22	15	54	63	63	64	15	80	21	86	48	17	11	68	92	16	17	49	36	05	17	80	24
67	85	26	91	23	14	28	01	76	47	65	12	58	24	27	61	59	43	20	15	93	47	30	56	27
13	91	16	76	91	97	85	48	99	50	40	96	80	66	97	82	66	06	90	97	65	28	44	98	08
95	82	20	95	52	65	95	03	48	75	64	25	04	13	85	80	13	37	08	18	09	28	63	07	69
44	06	82	49	28	27	84	53	42	85	44	12	40	64	85	06	28	14	87	23	97	88	07	60	80
99	22	26	64	15	71	06	96	22	98	77	46	78	57	51	22	54	82	87	99	96	27	25	87	77
08	44	26	12	87	72	42	13	57	77	61	07	94	24	62	17	76	19	45	18	98	11	47	40	31
14	96	76	06	87	82	09	72	81	22	87	70	81	98	78	98	87	22	82	25	88	45	38	08	31
27	86	41	53	58	16	49	99	19	08	62	98	79	81	98	15	08	62	82	93	68	24	14	44	50
99	67	81	61	25	52	97	87	98	15	85	99	01	86	59	00	11	39	82	53	49	18	62	51	65
89	14	87	94	03	22	82	45	42	61	97	83	04	26	30	48	49	40	99	99	69	96	13	94	21
84	18	53	15	82	42	02	58	82	14	88	78	02	82	49	25	62	91	14	94	70	72	64	50	51
72	11	79	75	79	36	07	12	92	61	89	93	77	82	08	23	74	75	67	56	87	45	35	13	44
19	72	57	61	99	08	62	02	26	82	52	90	72	51	94	84	59	79	84	19	95	76	21	49	91
96	99	76	63	90	27	60	94	15	70	17	74	92	31	85	24	47	55	64	51	91	47	13	39	69
44	15	86	76	18	15	57	29	51	62	95	84	20	83	01	11	90	66	80	81	40	48	65	87	85
33	83	94	07	50	18	89	86	16	50	09	97	04	76	51	41	20	56	50	20	38	58	70	10	22
53	07	06	16	30	84	43	40	57	82	18	09	47	16	69	41	08	38	24	02	16	41	58	89	58

TABLE A-37. SHORT TABLE OF RANDOM NORMAL DEVIATES

$m = 0, \sigma = 1$

0.048	1.040	−0.111	−0.120	1.396	−0.393	−0.220	0.422	0.233	0.197
−0.521	−0.563	−0.116	−0.512	−0.518	−2.194	2.261	0.461	−1.533	−1.836
−1.407	−0.213	0.948	−0.073	−1.474	−0.236	−0.649	1.555	1.285	−0.747
1.822	0.898	−0.691	0.972	−0.011	0.517	0.808	2.651	−0.650	0.592
1.346	−0.137	0.952	1.467	−0.352	0.309	0.578	−1.881	−0.488	−0.329
0.420	−1.085	−1.578	−0.125	1.337	0.169	0.551	−0.745	−0.588	1.810
−1.760	−1.868	0.677	0.545	1.465	0.572	−0.770	0.655	−0.574	1.262
−0.959	0.061	−1.260	−0.573	−0.646	−0.697	−0.026	−1.115	3.591	−0.519
0.561	−0.534	−1.730	−1.172	−0.261	−0.049	0.173	0.027	1.138	0.524
−0.717	0.254	0.421	−1.891	2.592	−1.443	−0.061	−2.520	−0.497	0.909
−2.097	−0.180	−1.298	−0.647	0.159	0.769	−0.735	−0.343	0.966	0.595
0.443	−0.191	0.705	0.420	−0.486	−1.038	−0.396	1.406	0.327	1.198
0.481	0.161	−0.044	−0.864	−0.587	−0.037	−1.304	−1.544	0.946	−0.344
−2.219	−0.123	−0.260	0.680	0.224	−1.217	0.052	0.174	0.692	−1.068
1.723	−0.215	−0.158	0.369	1.073	−2.442	−0.472	2.060	−3.246	−1.020
−0.937	1.253	0.321	−0.541	−0.648	0.265	1.487	−0.554	1.890	0.499
−0.568	−0.146	0.285	1.337	−0.840	0.361	−0.468	0.746	0.470	0.171
−1.717	−1.293	−0.556	−0.545	1.344	0.320	−0.087	0.418	1.076	1.669
−0.151	−0.266	0.920	−2.370	0.484	−1.915	−0.268	0.718	2.075	−0.975
2.278	−1.819	0.245	−0.163	0.980	−1.629	−0.094	−0.573	1.548	−0.896
−0.650	0.669	−0.761	0.154	0.872	0.914	−0.563	−1.434	−0.006	−0.975
−1.086	0.810	0.461	−0.528	2.130	−0.218	0.111	−0.412	−0.580	−1.487
−0.143	−1.196	−1.254	−0.133	0.937	−0.475	−2.348	0.618	−0.057	−0.710
−2.072	0.711	1.241	0.066	−0.341	0.356	1.220	0.431	0.263	−1.623
−0.394	−0.368	−2.108	0.605	0.485	2.068	0.687	−1.474	0.071	−1.196
0.174	−1.131	0.870	2.114	0.201	−0.373	−0.284	−0.234	−2.087	−1.304
0.020	0.102	−1.911	−1.132	1.267	0.420	0.791	1.548	−0.147	−0.453
0.297	0.449	−0.604	−0.858	−1.739	1.143	0.131	0.740	−1.596	0.165
1.160	0.253	0.716	−1.032	−0.595	−1.662	0.632	−0.315	−0.374	0.700
−0.351	−0.490	−0.632	−0.409	−0.116	−1.153	−0.266	−0.125	0.489	−0.366
−0.594	−0.214	−0.461	0.030	−0.595	−0.889	0.638	−0.488	0.418	−0.693
−1.882	1.890	−0.236	0.006	0.966	−0.723	0.229	−2.136	−1.017	−0.008
0.041	2.955	−1.526	2.114	−0.540	1.040	0.753	0.025	0.462	1.221
−0.403	1.237	−1.938	−1.704	−0.103	−0.346	1.214	0.826	0.336	−1.140
−0.068	0.599	0.192	1.503	−0.579	−1.485	−1.645	0.302	−1.348	0.553
−0.361	0.958	0.807	0.787	−0.547	−0.074	−1.378	−0.010	−1.096	0.789
−0.251	0.629	0.459	−0.165	0.016	0.489	−1.205	−0.260	−0.256	−0.399
−1.011	0.893	−0.741	−0.514	−0.576	−0.929	0.478	−0.374	1.950	−0.695
0.780	−2.464	−0.522	0.767	−1.657	−0.983	0.217	−0.529	−0.648	1.454
−0.712	−0.355	−0.564	1.052	−0.169	−0.410	1.543	−2.330	−0.008	−0.955
−0.612	−1.068	−0.644	−0.007	−0.835	0.623	0.093	0.105	−0.318	−0.228
−0.064	0.012	−0.676	0.349	0.303	1.539	0.792	−0.101	−0.344	−0.096
−0.379	1.504	2.375	0.498	−0.996	0.174	−1.268	−1.137	−0.618	0.173
1.145	−1.403	0.770	0.799	0.844	−1.361	−1.059	0.128	1.398	0.277
−0.117	0.585	−1.763	−0.632	0.239	−0.854	1.684	1.024	−0.067	−0.045
1.333	1.374	−0.515	−1.655	0.607	−0.885	−0.902	−1.010	−1.297	−0.139
−0.249	−0.747	1.044	−0.930	0.346	0.575	0.335	−1.159	−1.651	−1.642
−1.022	0.085	−1.441	−0.198	0.844	0.697	0.548	−0.080	0.656	0.443
−0.780	−0.534	−0.339	−0.642	−0.902	−0.827	0.071	−0.678	−0.359	−0.479
−0.687	−0.418	0.991	0.331	−1.003	0.061	−1.416	0.876	0.125	−2.246

TABLE A-37 (Continued). SHORT TABLE OF RANDOM NORMAL DEVIATES

$m = 0, \sigma = 1$

−0.670	0.518	0.387	0.523	0.641	1.243	0.322	−2.607	−1.097	−0.012
−2.912	1.448	1.343	−0.122	0.726	−0.617	0.609	2.319	−0.450	−1.197
−0.028	−0.790	0.057	1.425	1.940	1.161	−0.878	−0.716	−0.244	−1.151
−1.257	0.774	0.003	0.388	1.060	1.028	−0.236	1.172	0.442	−0.157
2.372	−1.376	−1.318	1.236	0.738	0.337	−0.534	0.090	0.886	0.676
−0.970	0.438	−0.672	−0.180	0.667	1.370	−0.481	0.329	0.842	0.449
−1.228	0.129	−0.426	−0.165	0.028	2.696	1.201	−1.351	0.724	−1.017
−0.369	0.310	0.432	0.237	0.884	−1.224	0.539	0.852	0.497	−0.283
1.161	1.219	1.615	0.336	1.100	−0.528	0.161	0.278	0.675	−1.143
−0.284	2.609	0.792	1.825	−0.249	1.654	0.621	0.979	−1.472	−1.173
−0.578	−0.789	0.106	0.832	−0.597	0.496	−0.561	−1.033	−0.578	−0.378
0.074	0.261	−0.766	−1.046	0.361	−0.043	−1.927	1.527	0.605	1.475
0.230	0.046	0.978	−1.901	1.162	−0.545	0.697	1.151	2.033	0.080
2.162	−0.562	1.190	0.925	−1.057	0.015	−1.371	1.067	−1.080	−1.129
−1.020	−1.130	−0.315	0.628	−0.140	2.050	−0.030	−0.629	0.128	−1.221
1.323	−0.836	−0.284	−0.249	−0.768	1.242	−0.879	−0.417	0.013	−0.502
2.329	1.884	0.033	0.598	−0.217	0.260	0.431	−1.914	0.205	1.155
2.761	1.800	−0.562	0.714	−0.407	0.009	−0.724	−1.168	0.247	1.166
−0.232	0.605	−0.023	−0.531	0.542	−0.155	0.697	1.037	−0.316	−0.003
−0.742	0.210	−0.741	−1.099	0.158	2.112	−0.765	−0.319	−0.247	0.345
−1.410	0.413	0.705	1.444	1.057	−0.843	0.043	−0.571	−0.001	0.203
2.272	−0.719	0.679	2.007	−0.180	0.698	−1.137	0.688	−0.571	−0.100
2.832	0.925	−1.350	1.529	−0.260	−1.007	−2.350	−1.501	0.289	1.522
−1.086	−0.558	−0.973	−1.285	−0.021	0.077	0.915	−0.241	−0.249	−0.529
0.134	1.815	0.313	1.571	−0.216	2.261	0.696	−0.130	0.393	0.017
0.783	0.600	−0.745	1.127	−0.684	−0.519	0.125	−0.499	1.543	−0.082
0.174	−0.897	0.575	−0.751	0.694	−2.959	0.529	1.587	0.339	−0.813
−1.319	0.556	2.963	1.218	1.199	−1.746	1.611	0.467	−0.490	0.202
1.298	−0.940	−1.143	−1.136	−1.516	0.548	0.629	0.250	−1.087	0.322
−0.676	−1.107	−1.483	0.278	0.493	−0.442	1.078	−0.336	−0.177	−0.057
−1.287	0.775	−1.095	1.161	−1.877	1.874	1.703	−1.619	−0.725	−1.407
0.260	−0.028	−1.982	0.811	0.999	1.662	0.908	1.476	−1.137	−0.945
0.481	1.060	1.441	0.163	0.720	1.490	−0.026	−0.502	0.427	−0.351
0.794	0.725	1.971	0.384	−0.579	−1.079	−1.440	−0.859	−0.346	0.077
0.584	−0.554	1.460	0.791	−0.426	−0.682	0.430	1.922	−2.099	0.221
−0.114	0.379	−0.698	1.570	−0.511	−0.725	0.680	−0.591	−1.091	0.357
−1.128	−1.707	0.921	−0.859	−1.566	1.523	−0.900	−0.988	0.264	0.282
0.691	0.153	0.076	1.691	0.553	0.457	−1.107	0.322	0.633	0.007
1.115	0.777	−0.738	0.868	1.484	−1.792	0.950	−0.842	−0.192	0.620
−0.389	0.559	0.670	−0.315	1.234	0.475	1.117	1.286	−0.649	−1.880
0.330	0.750	−0.642	0.148	−0.608	0.866	−1.720	0.653	−0.210	−0.959
−0.333	−0.084	1.239	−0.049	−0.095	−0.197	−0.213	−1.420	−0.491	0.102
1.718	1.111	−0.548	−0.653	1.534	−0.456	−0.395	1.614	−0.531	−0.785
−0.182	0.620	1.178	−1.071	0.444	−0.072	−1.001	1.325	−0.302	−1.119
1.260	−1.192	0.182	−0.397	−0.705	−1.085	−1.492	1.642	0.673	−0.707
−1.204	−1.725	1.695	1.473	0.665	−0.489	0.020	0.267	1.230	0.865
−0.619	0.307	−0.226	−0.096	0.987	−1.195	−1.412	0.433	2.052	0.022
−0.272	−0.096	0.137	−0.361	0.653	−0.156	1.309	−0.480	−0.397	1.302
0.245	−0.690	0.493	−1.123	1.465	0.132	0.582	−0.429	0.225	0.125
0.101	−0.855	0.782	−1.040	2.113	−1.423	−1.010	0.158	0.106	−1.232

TABLE A-37 (Continued). SHORT TABLE OF RANDOM NORMAL DEVIATES

$m = 0, \sigma = 1$

0.117	−0.136	0.820	−1.213	0.131	−0.738	0.918	1.002	−0.846	0.288
0.519	−0.787	−1.128	1.100	1.609	0.797	0.382	−1.157	−1.320	−2.056
−0.876	−0.832	−0.788	1.490	−0.923	−0.710	−2.149	−1.967	0.088	1.158
0.311	0.494	0.357	0.025	−0.016	0.448	0.733	−0.199	0.440	0.609
−1.041	0.627	−0.957	0.777	0.304	−0.581	1.495	−1.564	−1.471	−1.097
0.239	0.061	1.091	−0.060	0.521	−0.777	0.461	0.919	−0.091	1.412
−0.151	0.664	0.596	0.370	−0.346	−0.526	−1.557	−0.180	−0.323	0.918
0.962	−0.502	−0.967	0.859	0.916	−1.525	0.064	1.023	0.001	−1.577
1.573	−1.912	−1.010	1.780	−0.771	2.390	−0.188	−0.593	−0.608	−0.561
−0.742	0.137	0.563	0.887	−0.740	−1.410	−0.818	−0.545	1.130	−0.741
−0.143	−1.299	−1.869	0.191	−0.789	−0.296	−2.232	0.268	−1.582	0.389
−1.433	1.169	−0.733	1.176	−0.582	1.060	0.447	0.305	−2.418	−1.209
−1.946	1.045	−1.705	−1.544	1.701	0.972	0.346	−0.341	−1.240	−0.194
−0.885	0.247	−1.230	−1.461	0.175	2.072	1.174	−0.223	−1.106	0.028
−0.046	0.513	−0.201	−0.740	0.727	0.668	−0.433	−0.991	−0.174	1.421
−0.683	−0.161	0.964	−1.182	0.485	0.901	1.321	0.803	−0.727	−0.569
−0.749	−0.029	−1.150	0.122	−0.016	−0.690	1.261	1.884	0.758	−0.035
0.995	0.542	0.448	0.796	0.616	0.261	1.072	−1.153	−1.866	−1.029
0.274	−0.188	−0.846	1.557	0.554	0.514	0.723	−0.322	−0.805	0.178
1.120	−0.396	2.110	−1.469	−0.589	0.779	0.338	−0.093	1.629	0.134
−0.668	−0.678	0.406	0.092	0.944	−0.728	−0.358	−1.206	−0.783	0.510
1.583	−0.730	−0.911	0.126	1.864	−0.296	−0.980	−1.022	0.315	0.274
1.050	1.162	1.236	−2.039	−1.299	−0.722	−0.630	1.359	0.511	0.448
0.477	−0.433	0.110	−0.182	−0.363	0.716	−1.355	1.579	−0.574	0.043
−1.538	0.137	−0.382	0.578	1.053	0.489	1.552	1.520	0.391	−1.026
−0.314	−0.889	−0.913	0.417	0.537	−0.426	−0.100	1.467	0.483	−0.627
0.730	−0.946	−0.231	−0.671	−0.798	1.330	−1.006	−0.123	0.442	1.513
0.276	−0.473	0.477	1.076	0.316	−0.600	−0.146	0.090	−0.608	−1.198
−0.638	−1.270	−0.447	−1.101	−1.107	−1.433	0.349	0.546	−0.283	0.887
0.497	−0.829	0.745	0.469	1.975	0.130	0.367	0.202	−0.433	0.630
−0.769	−0.866	−1.034	−1.615	0.120	0.493	0.103	−0.639	1.732	1.066
−1.384	0.453	0.586	−1.549	−0.421	0.815	−1.319	−0.805	−0.009	−0.100
0.784	1.980	−1.265	0.239	1.189	−0.382	0.047	−0.582	0.806	−1.336
−0.035	−0.514	−0.087	−0.202	0.925	−0.047	−0.926	−1.157	0.498	−1.066
0.678	0.917	0.376	1.282	−1.176	0.622	2.123	0.646	−0.730	0.026
0.179	0.841	−0.298	−2.437	−0.740	−0.039	0.226	0.247	−1.614	0.492
0.111	−0.044	0.209	0.527	0.598	−0.206	−1.042	−0.012	0.757	0.840
1.006	−0.919	0.956	0.808	1.793	−0.079	1.953	−1.494	0.559	1.290
−0.307	−1.174	−0.858	0.039	−1.505	0.037	−0.107	0.120	0.557	1.809
−2.467	0.273	−0.899	−0.691	−1.092	−1.374	1.238	2.046	0.879	0.296
0.275	−1.313	−0.331	0.305	0.404	−0.399	0.591	0.280	−1.802	1.207
−0.514	−0.713	0.501	1.214	0.001	0.360	−0.124	1.373	1.857	−1.135
0.982	−0.139	1.113	−0.433	−0.761	0.182	−0.405	0.714	−0.616	−1.402
−0.071	−0.115	−0.344	0.429	0.316	−0.667	1.676	−0.155	1.085	−1.780
−1.975	−1.416	1.367	−0.592	0.480	0.406	0.701	1.077	−1.475	1.024
0.027	−1.446	−0.464	−1.180	1.223	−1.116	−1.017	1.051	0.051	−0.853
0.016	−1.118	−1.228	1.382	−0.502	0.494	−0.612	2.755	−0.809	−1.216
0.584	−1.410	−0.551	−0.602	−0.381	−0.078	−1.310	1.198	1.359	0.115
0.669	−0.611	−0.452	0.302	−1.026	−0.331	−1.047	0.618	0.931	−0.218
0.070	−1.598	−0.506	−0.812	1.203	−2.110	0.049	0.059	1.890	0.421

TABLE A-37 (Continued). SHORT TABLE OF RANDOM NORMAL DEVIATES

$m = 0, \sigma = 1$

1.801	0.459	1.102	−1.072	−0.336	0.942	−0.290	−0.716	1.396	−0.466
−0.175	−0.754	−0.134	1.231	1.483	−0.149	0.555	1.401	−1.142	0.205
−0.861	−1.460	0.526	0.239	−0.206	2.021	0.313	−0.253	−0.891	1.135
−0.577	0.335	−0.820	0.140	−0.333	0.426	0.209	−0.024	0.323	1.223
0.827	0.802	−0.457	0.560	0.643	−0.729	−0.249	0.338	−0.281	−1.804
−1.344	0.949	−1.459	−1.210	1.016	−0.148	−1.737	0.069	−1.185	0.040
1.476	1.262	−1.428	0.489	−0.523	−0.646	1.721	0.749	0.179	−0.922
0.527	−1.045	0.877	0.646	2.957	−0.972	−1.796	0.309	2.224	−0.070
−0.645	0.117	0.059	−0.080	−1.637	−0.746	1.256	2.520	−0.673	0.994
−0.514	−1.510	−0.714	−1.581	0.905	1.745	1.767	0.682	−0.648	−1.742
−0.656	−0.217	0.287	0.114	1.175	0.791	−0.263	−0.695	−1.348	1.239
−0.778	1.177	0.180	1.156	0.458	1.089	0.339	1.304	0.402	−0.831
0.352	−1.829	−0.645	0.236	0.641	0.920	−1.287	−0.187	−2.339	−0.237
1.352	−0.076	−1.962	0.827	0.252	1.621	0.770	1.324	0.488	−0.037
0.017	0.030	0.211	2.276	0.693	−1.733	0.773	0.652	−0.947	0.148
−0.218	−1.060	−0.553	1.043	2.305	0.380	−0.794	−1.498	1.088	−0.689
1.118	0.816	0.713	0.485	0.185	0.318	−1.050	0.110	0.563	1.177
−1.622	0.436	0.481	0.021	2.070	−0.845	−0.257	−0.680	−0.565	0.024
−1.103	−0.210	−1.088	−0.033	−1.022	0.366	−0.531	2.022	0.210	1.037
−0.677	−0.737	−0.950	−1.517	1.148	0.377	−0.397	−1.902	−0.748	−1.753
1.110	1.120	1.163	1.577	−1.172	−0.133	−0.213	0.154	−0.435	0.218
−0.278	0.569	0.586	1.523	−0.244	−0.170	−1.274	0.874	−1.020	−0.809
0.178	1.314	0.462	−0.253	−0.122	0.108	−1.256	−0.137	1.043	−0.135
0.312	−2.287	−0.655	−1.459	0.075	−0.457	−0.206	−0.326	0.489	−0.149
0.469	−2.066	−0.973	−1.009	−1.410	0.505	0.459	−0.572	−1.186	0.978
−0.730	1.650	0.760	−0.520	−0.671	−0.122	−0.324	−0.202	0.411	−2.103
0.834	0.280	0.744	0.598	0.122	−0.460	−1.310	−1.271	−0.917	0.650
−1.397	−1.053	0.412	1.286	−0.820	−0.371	0.826	−0.666	0.505	0.733
0.238	−0.668	1.861	0.051	0.460	0.079	1.008	−0.487	0.306	−0.061
0.102	−0.907	−0.833	1.103	−0.921	0.145	−0.904	−0.401	0.553	−1.422
−0.160	0.567	−0.638	0.355	0.427	−0.695	−0.846	0.359	1.500	−0.926
0.496	1.179	−0.776	0.511	−1.325	0.275	−0.130	−0.123	1.175	−0.102
0.307	−0.328	−2.474	−0.121	1.371	0.266	1.235	1.827	−0.296	−2.715
−0.559	0.523	1.264	−0.018	−2.791	0.139	1.515	1.976	0.173	−1.728
0.658	−0.261	0.004	−1.296	0.568	−1.215	0.104	0.178	1.126	1.134
−0.856	−2.278	−0.140	−0.164	1.416	−0.043	0.243	−1.399	−0.448	0.120
2.778	0.245	0.282	0.301	−1.506	1.805	1.798	1.078	1.629	−0.648
0.543	0.761	−2.038	−0.533	−0.594	1.742	0.487	1.432	−0.210	−0.358
−0.008	−0.445	−2.551	0.935	1.961	−0.270	−1.557	−1.318	−0.744	−0.860
−1.147	−1.151	−0.522	−2.118	−0.667	0.906	0.639	1.005	−0.480	−1.354
−0.851	0.585	0.672	0.481	−0.888	−0.480	0.041	0.345	−0.537	−0.589
0.023	0.609	0.623	0.356	0.279	−0.051	0.158	−0.353	0.776	0.102
−0.257	0.152	−1.413	0.175	0.149	−1.354	0.286	1.794	−0.571	−0.202
−0.421	−0.344	−0.803	0.832	0.256	−1.296	−1.390	0.379	0.955	0.366
−1.681	2.444	−1.025	1.178	−0.827	−0.200	0.727	0.778	0.169	−1.363
0.717	−1.666	1.071	−2.061	−1.367	−0.450	−0.038	−1.004	−1.240	0.901
−1.266	0.256	−1.312	−0.582	−0.351	−1.002	0.648	0.873	0.015	0.641
0.350	0.552	−1.549	−1.680	1.417	−0.769	−0.514	−1.900	1.017	−1.222
−0.186	0.006	0.148	0.560	−1.081	−0.637	−1.968	−0.623	0.009	−0.369
1.359	1.027	0.740	−2.067	0.543	1.099	0.543	0.064	0.589	−0.016

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